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COLLECTED DATA FOR TESTS ON A NACA 0012 AEROFOIL

VOLUME I : *Pressure data from ramp function tests.*

by

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February 1992

COLLECTED DATA FOR TESTS ON A NACA 0012 AEROFOIL

Herein is presented the collected data for tests in which a NACA 0012 aerofoil was subjected to a variety of ramp-type displacements in pitch about the quarter-chord location at low Reynolds numbers.

VOLUME I

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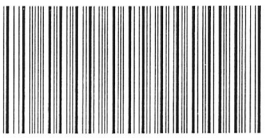

NACA 0012 - VOLUME I

CONTENTS

NOMENCLATURE

c	chord
C_m	pitching-moment coefficient
C_n	normal force coefficient
C_p	pressure coefficient
C_t	"thrust" force coefficient
D.P.	dynamic pressure ($\rho V^2/2$)
k	reduced frequency ($\omega c/2V$)
r	reduced pitch-rate ($c/2V)d\alpha/dt$
Re	Reynolds number
V	velocity
x/c	chordwise dimension
α	angle of attack
ω	rotational velocity

1 INTRODUCTION

The phenomenon of dynamic stall, the onset of which is largely controlled by the behaviour of the viscous boundary layer on the aerofoil surface, plays an important role in the successful design of the helicopter rotor. During high speed forward flight conditions, the blades on the retreating side of the rotor disc encounter a reduced dynamic pressure, and hence rotor trim requirements dictate a high aerofoil lift coefficient. These high lift coefficients are generated through large angles of incidence, often exceeding the maximum static stall value and so take advantage of the dynamic effects on the stalling process. Aerofoil dynamic stall is imprecisely understood and is currently the subject of extensive experimental and theoretical investigation by, amongst others, **Beddoes**[1]. As has been shown by **Harris and Pruyn**[2], attempts to predict rotor performance without a mathematical model of retreating-blade stall have met with little success. Furthermore, the modelling is complicated by the highly three-dimensional flowfield of the rotor. It is clear, however, that, in order to formulate modelling techniques for use in rotor airload calculations, a basic understanding of the unsteady stall process must be established.

An experimental investigation of retreating-blade stall, together with a boundary-layer analysis on a model rotor, by **McCroskey et al**[3,4] pointed to the modelling of blade dynamic stall by an oscillating aerofoil in the nominally two-dimensional flow environment of a wind tunnel. Many such experiments of aerofoils oscillating through stall have since been performed, and data have been gathered for both the analysis of the fluid mechanics of the dynamic stall phenomenon itself and for use in mathematical model development.

As part of this investigation, in recent years, in the dynamic stall facility at the University of Glasgow[5,6,7], two-dimensional data have been acquired from experiments on a number of aerofoils under a variety of motion types. These aerofoils can be divided into two groups: the first is a family of cambered aerofoils generated from the NACA 23012 section and intended for the examination on helicopter blades of the transition from trailing-edge to leading-edge stall and the mechanism of reattachment; the second is a series of symmetrical sections for use on large-scale vertical-axis wind turbines. This report, which is the first of two, presents the collected data from a series of ramp tests performed on a NACA 0012 aerofoil, from the second of these groups. The coordinates for this aerofoil section are listed in **Table 1**. The experiments are split between the three volumes as follows:

VOLUME I *Pressure data from ramp function tests.*

VOLUME II *Pressure data from oscillatory tests.*

Each volume also includes the pressure data from tests in steady conditions and a brief description of the experimental apparatus and techniques.

2 DESCRIPTION OF TEST FACILITY

2.1 Aerofoil and Wind Tunnel

The general arrangement of the aerofoil in the wind tunnel was as shown in **Figure 1**. The aerofoil, of chord length 0.55m and span 1.61m, was constructed of fibre glass mounted on an aluminium spar and filled with an epoxy resin foam. The hand-finished surface was very smooth, and the profile accurate to better than 0.1mm. The instrumented model was fitted vertically into the University of Glasgow's "Handley Page" wind tunnel.

The "Handley Page" low-speed wind tunnel is an atmospheric-pressure closed-return type with a 1.61x2.13 octagonal working section

(**Figure 2**) in which a wind velocity of 61ms^{-1} can be attained. The model was pivoted about its quarter-chord axis on two tubular steel shafts connected to the main support via two self-aligning bearings. A single thrust bearing on the top support beam took all the weight. The dynamic and aerodynamic loadings from the aerofoil were reacted to the tunnel framework by two transversely mounted beams.

2.2 Pitch Drive Mechanism

2.2.1 Actuator

Angular movement of the model was obtained using a linear hydraulic actuator and crank mechanism. The actuator was mounted horizontally below the tunnel working section on the supporting structure, with the crank rigidly connected to the tubular part of the spar by a welded sleeve and keyway. The acuator was a UNIDYNE 907/1 type with a normal dynamc thrust of 6.1KN operated from a supply pressure of 7.0MNm^{-2}. A MOOG 76 series 450 servo valve was used via a UNIDYNE servo controller unit to control the movement of the actuator. A suitable feedback signal for the controller was provided by a precision linear angular displacement transducer geared to the main spar of the model.

2.2.2 Command Signal

The model's angle of attack was incremented by the actuator controller. The input signal during the static tests was provided under software control by the data acquisition unit's own digital-to-analogue converter. This was possible because, during the sampling, the angle of attack was fixed and sufficient time was available between sampling to set the model at the required angle of attack. The two activities were separate and were performed sequentially.

Such was not the case during the unsteady tests, however, where sampling and control of the model's motion were required simultaneously. Therefore, during these tests, the input signal was provided by a separate function generator, comprised of an AMSTRAD 1512 microcomputer equipped with an ANALOG DEVICES RTI815 multi-function input/output board. The required output function was digitised into equal time steps in 2's complement code and the frequency of the function was controlled using the internal interrupts of the AMSTRAD microcomputer. The code was written in TURBO PASCAL.

2.3 Instrumentation and Data Logging

2.3.1 Pressure Transducers

To provide the chordwise pressure distribution at mid-span, thirty KULITE XCS-093-5 PSI G ultra-miniature pressure transducers were installed just below the surface of the centre section of the model. The transducers were of vented gauge type with one side of the pressure sensitive diaphragm open to the ambient pressure outside the wind-tunnel (via tubes in the model). Each transducer was fitted with a temperature compensation module, which minimised the change in zero-offset and sensitivity with temperature. The locations of the pressure transducers in the model are illustrated in **Figure 3**.

The low voltage outputs from the thirty presure transducers were suitably amplified and conditioned by a bank of differential amplifiers. The conditioned signals were passed to a "sample and hold" unit[5,8] to overcome the time-skew problem arising from the sequential conversion of the anlogue signals into digital form.

2.3.2 Dynamic Pressure

The dynamic pressure in the wind tunnel working section was determined by measuring the difference between the static pressure in the working section, 1.2m upstream of the leading edge, and the static pressure in the settling chamber. The pressure tappings were connected to a FURNESS FC012 micromanometer, which provided an analogue signal suitable for the data acquisition unit's analogue-to-digital converter. This dynamic pressure was recorded as the sample-and-hold unit was triggered to sample the output from the pressure transducers.

2.3.3 Incidence

The instantaneous angle of attack of the aerofoil was determined by an angular displacement transducer geared to the model's main spar. The signal voltage from the transducer was fed into an amplifier/splitter to produce three signals for the following purposes:

i) connection of the multiplexer for recording the aerofoil's angle of attack;

ii) connection of the Schmitt trigger for initiation of data sampling when a preset incidence (voltage) was attained;

iii) a feedback signal to the hydraulic actuator controller.

2.3.4 Acquisition Unit

The actual data acquisition unit was a DEC MINC-11 microcomputer, configured with an LSI-11/32 16-bit microprocessor and laboratory modules which included:

i) an analogue-to-digital converter module, with a 16-channel multiplexer incorported. The converter was a 12-bit successive approximation type with a conversion time of of 30μs, but the multiplexer's settling time and the need to transfer the data from the analogue-to-digital converter into system memory increased the conversion time to 44μs;

ii) a multiplexer module, of 16 single-ended channels, which increased the number of channels that could be sampled to 32;

iii) a real-time clock module, with two Schmitt triggers. This was used as a time-base generator to accurately set the sampling frequency. The sampling frequency was determined at run time from the pitch rate and the requirement that 128 sample sweeps should be obtained when the incidence was increasing and the same number when the aerofoil was sitting at its final incidence. However this specification was qualified by the fact that data were required to be recorded at the final incidence for no longer than 4 seconds and that the maximum sampling frequency which could be attained was 550Hz. One of the Shmitt triggers was used to initiate data sampling, by setting its reference voltage to a value corresponding to the angular displacement transducer's output for the required starting angle of attack;

iv) a digital-to-analogue converter module which housed four independent 12-bit digital to analogue converters. This was used to provide the command signal for the hydraulic actuator during static tests.

The path of data flow and system layout is shown diagrammatically in **Figure 4**. The main control programs for the tests were written in FORTRAN IV, as described by **Murray-Smith and Galbraith**[9]. The programs prompt the user for specific run information before calling a specialised subroutine written in MACRO-11 assembly language to receive and store the digitised data. The timing and control of the analogue-to-digital converter and associated circuitry was performed by the processor's hardware, but channel selection and data management were achieved under software control.

3 TEST SERIES AND PROCEDURE

3.1 Static Experiment

A number of experiments were performed under steady conditions. Once the wind velocity had reached the required value, the aerofoil was rotated about its quarter-chord axis until it was positioned at the incidence at which the first set of data were to be recorded. Usually, this was approximately -2°. The model's angle of attack was then increased in steps of approximately 0.5°. After each increment in incidence, the flow was allowed to stabilise for a few seconds before each transducer's output was sampled 100 times and the mean value for each was stored. After 64 sweeps of data had been recorded, the model was returned to its starting position. Data sampling was maintained at the same rate on the return arc in order to record any delay in the reattachment of flow.

3.2 Ramp Experiment

During a ramp test the aerofoil was rotated about its quarter-chord axis over a preset arc at a constant pitch-rate. Five cycles of 256 data sweeps were recorded during each experiment. Between each ramp, the model sat at the finishing angle for five seconds, moved smoothly back to the starting angle in five seconds and sat at this position for another five seconds. Experiments were performed both when the pitch-rate was positive ("ramp up") and when it was negative ("ramp down").

As part of the University's ongoing assessment of the quality of the data recorded in its wind tunnels, it was decided to repeat a number of ramps over a negative incidence range. For these "inverted" ramps, all incidences and pitch-rates are the negative of those in the "standard" ramps.

3.3 Procedure

Before each individual set of tests, the tunnel was shut down and the air flow allowed to cease before the transducer offsets were logged. Immediately after these values were recorded, the appropriate data acquisition routine was initiated whilst the tunnel was brought up to speed and thence data gathered as per the software prompts. The tunnel was then shut down, offsets logged again and further tests were performed in the manner described above.

3.4 Data Presentation

All data collected by the data acquisition routines were stored in unformatted form on magnetic tape. A library of programs (coded in FORTRAN 77) is available for the reduction, presentation and analysis of the data on a DEC MICROVAX 3400. By applying offsets, gains and calibrations, the data reduction programs convert the cycles of raw data into averaged or unaveraged non-dimensional pressure coefficients. As described by **Leitch and Galbraith**[10], these data are stored on the University of Glasgow's aerofoil database. The airloads are determined by suitably integrating the pressure coefficient values.

4 RESULTS AND DISCUSSION

4.1 Tunnel Performance

Assessment of the quality of the data can only be made with a clear insight of the tunnel effects. Unfortunately the tunnel performance was such that, for the time scales of the model motion, it was not possible to hold the dynamic pressure in the working section constant whilst altering the blockage due to the pitching of the aerofoil. During the static tests (i.e. **k**=0.0 and **r**=0.0), this variation was as illustrated in **Figure 5**, where it can be seen that there was approximately a 30% reduction in dynamic pressure as the angle of attack was increased from 0° to 30°. As illustrated in **Figures 6** and **7**, this reduction in dynamic pressure decreased as reduced frequency increased.

Figure 8 reveals that, during ramps, there was a drastic reduction and subsequent unsteadiness in the dynamic pressure during a test. The model was pitched to an incidence of 40° so that uniform ramp conditions existed at stall. Once the aerofoil had stalled, however, all significant data had already been collected and the corresponding dynamic pressure reduction was only in the region of 10%. The subsequent data are of little relevance to the current work and is presented merely for completeness.

4.2 Averaging of the Data

The main data in this report are the average of a number of cycles. Individual cycles are presented in **Figures 9** and **10** where it may be seen that, whilst minor random differences do exist from cycle to cycle, the salient features are highlighted by the averaging process. In addition, the sweep at which any event occurred did not vary. Therefore the given data may be considered as typical of aerofoil performance during any given individual cycle. This is particularly relevant when considering the detailed flow phenomena of separation and reattachment.

4.3 Test Data

The test data are grouped for each motion type with compact details of the specific tests

listed in **Tables 2** to **4**. It will be observed that, during a number of experiments (01851-01861, 02881-02971, 21771-21841 and 31871-31901), there was a temporary fault in the transducer located at 50% chord on the upper surface. The data are presented in uncorrected form.

In addition, it was decided, during a small number of the ramp experiments that data acquisition should be initiated at an angle of attack other than the starting incidence. However the starting angle and ramp arc which is listed in the information block and in **Tables 3.4 and 4.4** are those for the complete ramp and not only for the incidence range over which data were recorded. Such experiments can be detected clearly from the incidence histories on the plots.

ACKNOWLEDGEMENTS

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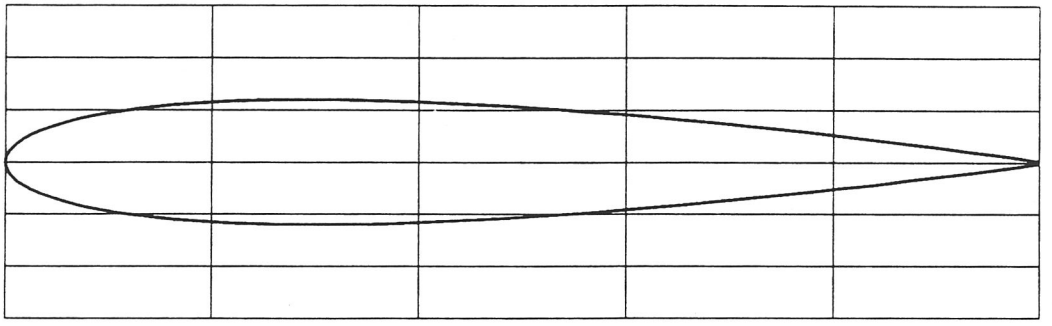
TABLE 1 : NACA 0012 AEROFOIL PROFILE AND COORDINATES



Coordinates in %Chord

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0.000	0.000	0.000	0.000
0.137	0.649	0.137	-0.649
0.548	1.276	0.548	-1.276
1.231	1.880	1.231	-1.880
2.185	2.458	2.185	-2.458
3.407	3.007	3.407	-3.007
4.894	3.522	4.894	-3.522
6.642	4.001	6.642	-4.001
8.645	4.437	8.645	-4.437
10.899	4.828	10.899	-4.828
13.397	5.168	13.397	-5.168
16.133	5.454	16.133	-5.454
19.098	5.682	19.098	-5.682
22.285	5.851	22.285	-5.851
25.686	5.957	25.686	-5.957
29.289	6.001	29.289	-6.001
33.087	5.981	33.087	-5.981
37.068	5.899	37.068	-5.899
41.221	5.755	41.221	-5.755
45.536	5.553	45.536	-5.553
50.000	5.294	50.000	-5.294
54.601	4.982	54.601	-4.982
59.326	4.618	59.326	-4.618
64.163	4.207	64.163	-4.207
69.098	3.751	69.098	-3.751
74.118	3.252	74.118	-3.252
79.209	2.710	79.209	-2.710
84.357	2.128	84.357	-2.128
89.547	1.504	89.547	-1.504
94.766	0.837	94.766	-0.837
100.000	0.126	100.000	-0.126

TABLE 2 : DETAILS OF STATIC TESTS

TABLE 2.1 : SUMMARY OF STATIC TESTS (nominal)

Reynolds Number	1.0×10^6	1.5×10^6	2.0×10^6
Angle of Attack	-2° to 30°		

(all permutations)

TABLE 2.2 : LIST OF STATIC TESTS (actual)

Run Number	Start (°)	Sweep (°)	Reynolds No. x 10^6
00011	-5	30	1.52
00021	-5	30	1.53
00031	-5	30	0.99
00041	-5	30	2.05
00051	-5	30	1.52
00061	-2	30	1.51
00071	-2	30	1.51
00221	-2	30	1.55
00851	-2	30	1.47
00861	-28	30	1.52
01341	-28	30	1.42
01351	-5	30	1.54
01731	-5	30	1.52
01741	-5	30	1.46
01751	-5	30	1.97
01761	-5	30	1.57
01851	-5	30	1.51
01861	-5	30	1.01
01951	-5	30	1.50
02871	-5	30	1.50
02881	-5	30	1.53
02971	-5	30	1.48
03201	-5	30	1.45
03361	-5	30	1.46
03751	-5	30	1.47
04131	-5	30	0.98
04301	-5	30	1.89
04471	-5	30	1.43

TABLE 3 : DETAILS OF RAMP UP TESTS

TABLE 3.1 : SUMMARY OF RAMPS FROM -1° TO 40° and 1° TO -40°
(nominal)

Pitch Rate	Reynolds Number $x10^{-6}$	Pitch Rate	Reynolds Number $x10^{-6}$	Pitch Rate	Reynolds Number $x10^{-6}$
0.75	1.5	75.0	1.5	215.0	1.5
1.5	1.5	90.0	1.5	230.0	1.5
3.0	1.5	100.0	1.0 1.5 2.0	245.0	1.5
4.5	1.5	115.0	1.5	260.0	1.5
6.0	1.5	130.0	1.5	275.0	1.5
7.5	1.5	145.0	1.5	290.0	1.5
15.0	1.5	160.0	1.5	300.0	1.0 1.5 2.0
30.0	1.0 1.5 2.0	175.0	1.5	315.0	1.5
45.0	1.5	190.0	1.5	330.0	1.5
60.0	1.5	200.0	1.0 1.5 2.0	345.0	1.5

(all permutations over both positive and negative incidence ranges)

TABLE 3.2 : SUMMARY OF RAMPS FROM -1° TO BETWEEN 23° AND 33°
(nominal)

Finishing Angle	23°	25°	27°	29°	31°	33°
Pitch Rate ($^{\circ}s^{-1}$)	100	150	200	250	300	350	400
Reynolds Number	1.5×10^6						

(all permutations)

TABLE 3.3 : SUMMARY OF RAMPS FROM -1° TO BETWEEN 15° AND 22°
(nominal)

Finishing Angle	15°	16°	17°	18°	19°	20°	21°	22°
Pitch Rate ($^{\circ}s^{-1}$)	125				175			
Reynolds Number	1.5×10^6							

(all permutations)

TABLE 3.4 : LIST OF RAMP UP TESTS (actual)

Run Number	Start (°)	Arc (°)	Pitch Rate ($^{o}s^{-1}$)	Reduced Pitch Rate	Reynolds No. x 10^6
20082	-1	41	357.0	0.0415	1.50
20092	-1	41	328.0	0.0380	1.49
20102	-1	41	339.8	0.0394	1.49
20112	-1	41	301.1	0.0270	0.79
20122	-1	41	311.2	0.0360	1.49
20132	-1	41	276.0	0.0319	1.48
20142	-1	41	278.5	0.0329	1.47
20152	-1	41	244.3	0.0288	1.46
20162	-1	41	241.4	0.0284	1.46
20172	-1	41	212.1	0.0249	1.45
20182	-1	41	210.5	0.0245	1.49
20192	-1	41	189.2	0.0220	1.48
20202	-1	41	183.9	0.0214	1.48
20212	-1	41	159.6	0.0185	1.48
20232	-1	41	153.8	0.0180	1.46
20242	-1	41	132.8	0.0156	1.46
20252	-1	41	124.2	0.0145	1.46
20262	-1	41	99.0	0.0116	1.46
20272	-1	41	94.5	0.0110	1.49
20282	-1	41	77.8	0.0091	1.48
20292	-1	41	58.2	0.0068	1.48
20302	-1	41	45.3	0.0053	1.47
20312	-1	41	28.0	0.0033	1.47
20322	-1	41	14.7	0.0017	1.47
20332	-1	41	6.9	0.0008	1.46
20342	-1	41	5.9	0.0007	1.46
20352	-1	41	4.3	0.0005	1.52
20362	-1	41	2.9	0.0003	1.52
20372	-1	41	1.4	0.0002	1.51
21361	-1	23	312.1	0.0363	1.53
21371	-1	25	326.2	0.0379	1.52
21381	-1	27	345.0	0.0401	1.52
21391	-1	29	326.4	0.0379	1.52
21401	-1	31	352.7	0.0416	1.46
21411	-1	33	355.9	0.0420	1.45
21421	-1	23	318.7	0.0375	1.50
21431	-1	27	312.0	0.0366	1.50
21441	-1	29	331.4	0.0389	1.49
21451	-1	31	331.9	0.0389	1.49
21461	-1	33	314.6	0.0369	1.49
21471	-1	23	280.0	0.0332	1.49
21481	-1	25	281.1	0.0333	1.48
21491	-1	27	292.6	0.0346	1.48
21501	-1	29	277.3	0.0328	1.48
21511	-1	31	298.8	0.0353	1.48
21521	-1	23	249.1	0.0293	1.49
21531	-1	25	239.0	0.0281	1.48

TABLE 3.4 : LIST OF RAMP UP TESTS (continued)

Run Number	Start (°)	Arc (°)	Pitch Rate ($^{\circ}s^{-1}$)	Reduced Pitch Rate	Reynolds No. x 10^6
21541	-1	27	226.7	0.0266	1.48
21551	-1	29	248.6	0.0292	1.48
21561	-1	31	228.0	0.0268	1.48
21571	-1	23	186.1	0.0219	1.48
21581	-1	25	186.7	0.0219	1.48
21591	-1	26	194.7	0.0228	1.48
21601	-1	27	251.9	0.0296	1.48
21611	-1	29	184.2	0.0216	1.48
21621	-1	23	137.3	0.0163	1.46
21631	-1	24	137.6	0.0163	1.46
21641	-1	25	147.5	0.0175	1.46
21651	-1	26	140.6	0.0166	1.46
21661	-1	27	146.1	0.0173	1.46
21671	-1	22	117.3	0.0138	1.46
21681	-1	23	118.5	0.0140	1.46
21691	-1	24	112.3	0.0132	1.46
21701	-1	25	119.3	0.0141	1.46
21711	-1	26	114.4	0.0135	1.46
21721	-1	25	311.5	0.0368	1.46
21771	-1	41	281.5	0.0493	1.02
21781	-1	41	199.6	0.0349	1.02
21791	-1	41	107.7	0.0189	1.02
21801	-1	41	27.1	0.0047	1.02
21811	-1	41	292.7	0.0262	1.96
21821	-1	41	195.5	0.0175	1.94
21831	-1	41	107.7	0.0096	1.94
21841	-1	41	28.0	0.0025	1.93
22461	-1	15	166.1	0.0197	1.53
22471	-1	16	163.7	0.0194	1.53
22481	-1	17	171.4	0.0202	1.52
22491	-1	18	163.0	0.0192	1.52
22501	-1	19	161.9	0.0192	1.47
22511	-1	20	164.1	0.0194	1.52
22521	-1	21	176.3	0.0208	1.51
22531	-1	22	165.9	0.0195	1.51
22541	-1	15	136.4	0.0163	1.49
22551	-1	16	126.8	0.0151	1.48
22561	-1	17	134.4	0.0160	1.48
22571	-1	18	125.1	0.0149	1.48
22581	-1	19	134.3	0.0160	1.48
22591	-1	20	129.8	0.0154	1.48
22601	-1	22	134.8	0.0160	1.47
24481	-1	41	7.0	0.0008	1.43
24491	-1	41	13.0	0.0015	1.42
24501	-1	41	28.2	0.0034	1.41
24511	-1	41	51.5	0.0062	1.39
24521	-1	41	69.4	0.0084	1.38
24531	-1	41	74.1	0.0089	1.38

TABLE 3.4 : LIST OF RAMP UP TESTS (concluded)

Run Number	Start (°)	Arc (°)	Pitch Rate ($^{\circ}s^{-1}$)	Reduced Pitch Rate	Reynolds No. x 10^6
*21051	1	-41	-337.8	-0.0399	1.47
*21061	1	-41	-344.8	-0.0407	1.47
*21071	1	-41	-318.6	-0.0376	1.46
*21081	1	-41	-318.6	-0.0375	1.47
*21091	1	-41	-294.8	-0.0346	1.47
*21101	1	-41	-297.4	-0.0349	1.47
*21111	1	-41	-261.0	-0.0308	1.46
*21121	1	-41	-261.8	-0.0308	1.46
*21131	1	-41	-232.0	-0.0273	1.46
*21141	1	-41	-232.0	-0.0273	1.45
*21151	1	-41	-204.1	-0.0239	1.46
*21161	1	-41	-203.9	-0.0239	1.46
*21171	1	-41	-175.2	-0.0205	1.46
*21181	1	-41	-169.6	-0.0199	1.45
*21191	1	-41	-146.6	-0.0174	1.45
*21201	1	-41	-139.6	-0.0165	1.44
*21211	1	-41	-116.2	-0.0137	1.44
*21221	1	-41	-106.8	-0.0126	1.44
*21231	1	-41	-90.4	-0.0106	1.45
*21241	1	-41	-79.5	-0.0094	1.44
*21251	1	-41	-57.6	-0.0068	1.44
*21261	1	-41	-44.9	-0.0053	1.44
*21271	1	-41	-28.6	-0.0034	1.43
*21281	1	-41	-14.8	-0.0018	1.43
*21291	1	-41	-7.1	-0.0008	1.42
*21301	1	-41	-5.9	-0.0007	1.42
*21311	1	-41	-4.2	-0.0005	1.43
*21321	1	-41	-3.0	-0.0004	1.43
*21331	1	-41	-1.4	-0.0002	1.43

(* "inverted" ramp up)

TABLE 4 : DETAILS OF RAMP DOWN TESTS

TABLE 4.1 : SUMMARY OF RAMPS FROM 40° TO -1° and 40° TO -1° (nominal)

Pitch Rate	Reynolds Number x10^{-6}	Pitch Rate	Reynolds Number x10^{-6}	Pitch Rate	Reynolds Number x10^{-6}
-0.75	1.5	-75.0	1.5	-215.0	1.5
-1.5	1.5	-90.0	1.5	-230.0	1.5
-3.0	1.5	-100.0	1.0 1.5 2.0	-245.0	1.5
-4.5	1.5	-115.0	1.5	-260.0	1.5
-6.0	1.5	-130.0	1.5	-275.0	1.5
-7.5	1.5	-145.0	1.5	-290.0	1.5
-15.0	1.5	-160.0	1.5	-300.0	1.0 1.5 2.0
-30.0	1.0 1.5 2.0	-175.0	1.5	-315.0	1.5
-45.0	1.5	-190.0	1.5	-330.0	1.5
-60.0	1.5	-200.0	1.0 1.5 2.0	-345.0	1.5

(all permutations over both positive and negative incidence ranges)

TABLE 4.2 : SUMMARY OF RAMPS FROM 30° TO -10° (nominal)

Starting Angle	30°						
Finishing Angle	-10°						
Pitch Rate ($^{\circ}s^{-1}$)	-1	-45	-100	-145	-200	-260	-330
Reynolds Number	$1.5x10^6$						

(all permutations)

TABLE 4.3 : SUMMARY OF RAMPS TO -10° AT 330°s^{-1} (nominal)

Starting Angle	24°	22°	20°	18°	16°	14°	12°	10°	8°	6°	4°
Finishing Angle	-10°										
Pitch Rate	-330°s^{-1}										
Reynolds Number	$1.5x10^6$										

(all permutations)

TABLE 4.4 : LIST OF RAMP DOWN TESTS (actual)

Run Number	Start (°)	Arc (°)	Pitch Rate ($^{\circ}s^{-1}$)	Reduced Pitch Rate	Reynolds No x 10^6
30381	40	-41	-329.1	-0.0391	1.50
30391	40	-41	-292.3	-0.0346	1.49
30401	40	-41	-306.2	-0.0363	1.48
30411	40	-41	-264.5	-0.0311	1.50
30421	40	-41	-278.4	-0.0326	1.49
30431	40	-41	-256.5	-0.0301	1.49
30441	40	-41	-258.9	-0.0304	1.49
30451	40	-41	-232.8	-0.0273	1.48
30461	40	-41	-229.1	-0.0269	1.48
30471	40	-41	-214.0	-0.0251	1.47
30481	40	-41	-214.3	-0.0253	1.47
30491	40	-41	-178.7	-0.0210	1.46
30501	40	-41	-178.7	-0.0210	1.46
30511	40	-41	-161.7	-0.0190	1.46
30521	40	-41	-153.0	-0.0179	1.47
30531	40	-41	-136.6	-0.0160	1.46
30541	40	-41	-125.7	-0.0147	1.46
30551	40	-41	-100.5	-0.0118	1.46
30561	40	-41	-89.3	-0.0106	1.48
30571	40	-41	-71.0	-0.0084	1.47
30581	40	-41	-61.0	-0.0072	1.46
30591	40	-41	-43.5	-0.0051	1.46
30601	40	-41	-30.8	-0.0036	1.48
30611	40	-41	-14.4	-0.0017	1.47
30621	40	-41	-7.4	-0.0009	1.47
30631	40	-41	-5.6	-0.0007	1.47
30641	40	-41	-4.5	-0.0005	1.46
30651	40	-41	-3.0	-0.0004	1.46
30661	40	-41	-1.1	-0.0001	1.46
30671	30	-40	-340.1	-0.0400	1.53
30681	30	-40	-242.4	-0.0284	1.52
30691	30	-40	-193.3	-0.0227	1.51
30701	30	-40	-139.9	-0.0166	1.50
30711	30	-40	-100.4	-0.0119	1.50
30721	30	-40	-42.3	-0.0050	1.49
30731	30	-40	-1.1	-0.0001	1.49

TABLE 4.4 : LIST OF RAMP DOWN TESTS (concluded)

Run Number	Start (°)	Arc (°)	Pitch Rate ($°s^{-1}$)	Reduced Pitch Rate	Reynolds No x 10^6
30741	24	-34	-324.1	-0.0382	1.48
30751	22	-32	-336.8	-0.0397	1.48
30761	20	-30	-317.5	-0.0374	1.48
30771	18	-28	-332.6	-0.0391	1.48
30781	16	-26	-307.7	-0.0360	1.48
30791	12	-22	-296.2	-0.0346	1.48
30801	10	-20	-301.4	-0.0352	1.48
30811	8	-18	-293.2	-0.0345	1.47
30821	6	-16	-276.6	-0.0326	1.47
30831	4	-14	-246.3	-0.0290	1.46
31871	40	-41	-252.7	-0.0446	1.00
31881	40	-41	-173.7	-0.0306	1.00
31891	40	-41	-96.7	-0.0171	1.00
31901	40	-41	-27.5	-0.0048	1.00
31911	40	-41	-258.1	-0.0232	1.97
31921	40	-41	-178.1	-0.0159	1.95
31931	40	-41	-96.3	-0.0086	1.94
31941	40	-41	-27.6	-0.0025	1.93
*30871	-30	40	352.8	0.0419	1.49
*30881	-30	40	241.7	0.0287	1.49
*30891	-30	40	193.7	0.0230	1.49
*30901	-30	40	142.1	0.0168	1.49
*30911	-30	40	100.2	0.0118	1.49
*30921	-30	40	42.7	0.0050	1.49
*30931	-30	40	1.1	0.0001	1.48
*30941	-24	34	325.8	0.0385	1.47
*30951	-22	32	344.9	0.0408	1.47
*30961	-20	30	324.8	0.0383	1.47
*30971	-18	28	328.8	0.0388	1.47
*30981	-16	26	308.0	0.0363	1.47
*30991	-14	24	313.5	0.0369	1.47
*31001	-12	22	300.3	0.0353	1.47
*31011	-10	20	293.9	0.0346	1.47
*31021	-8	18	268.2	0.0315	1.47
*31031	-6	16	270.9	0.0318	1.47
*31041	-4	14	252.8	0.0297	1.46

(* "inverted" ramp down)

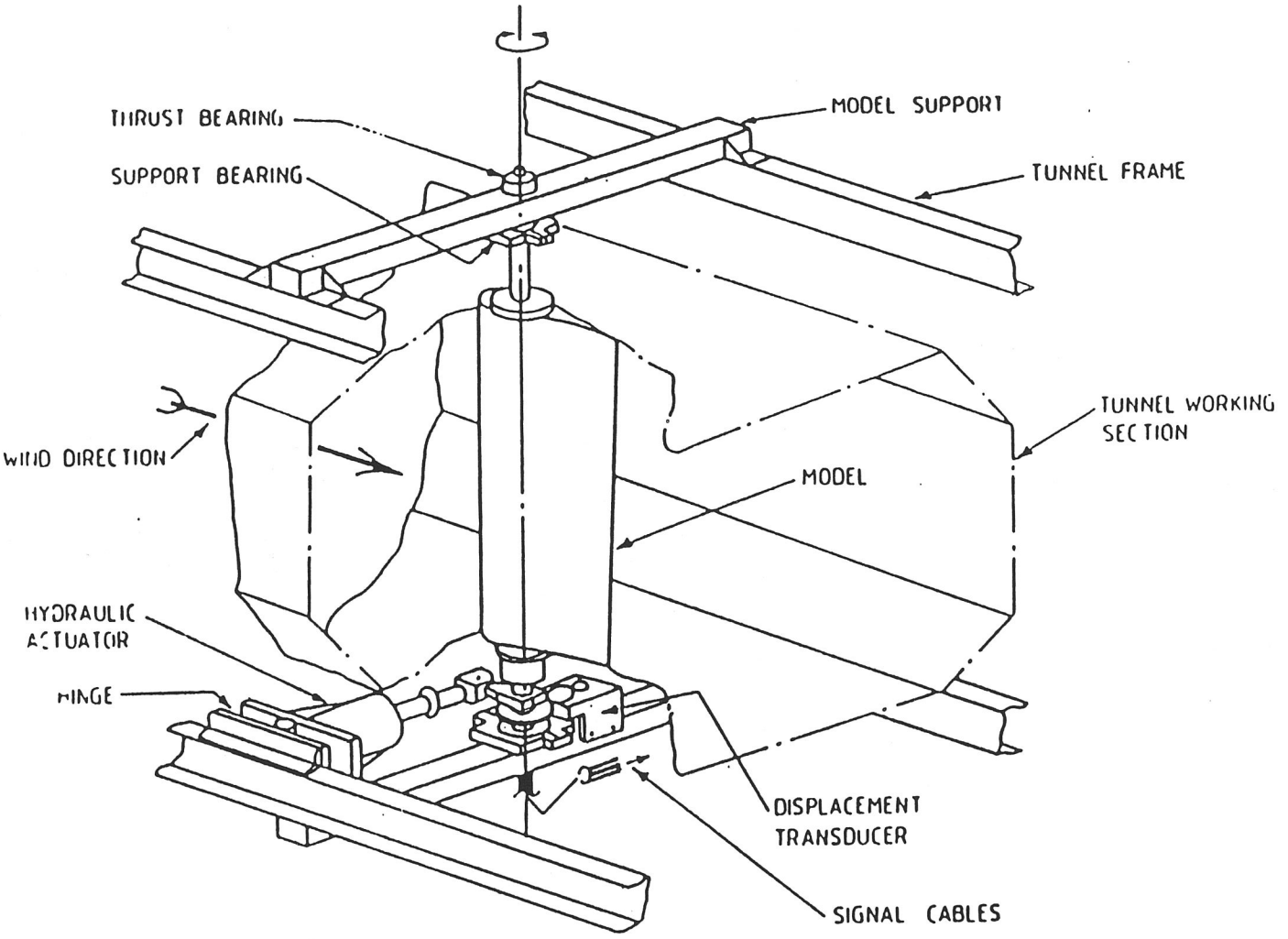


FIGURE 1 : GLASGOW UNIVERSITY'S DYNAMIC STALL RIG

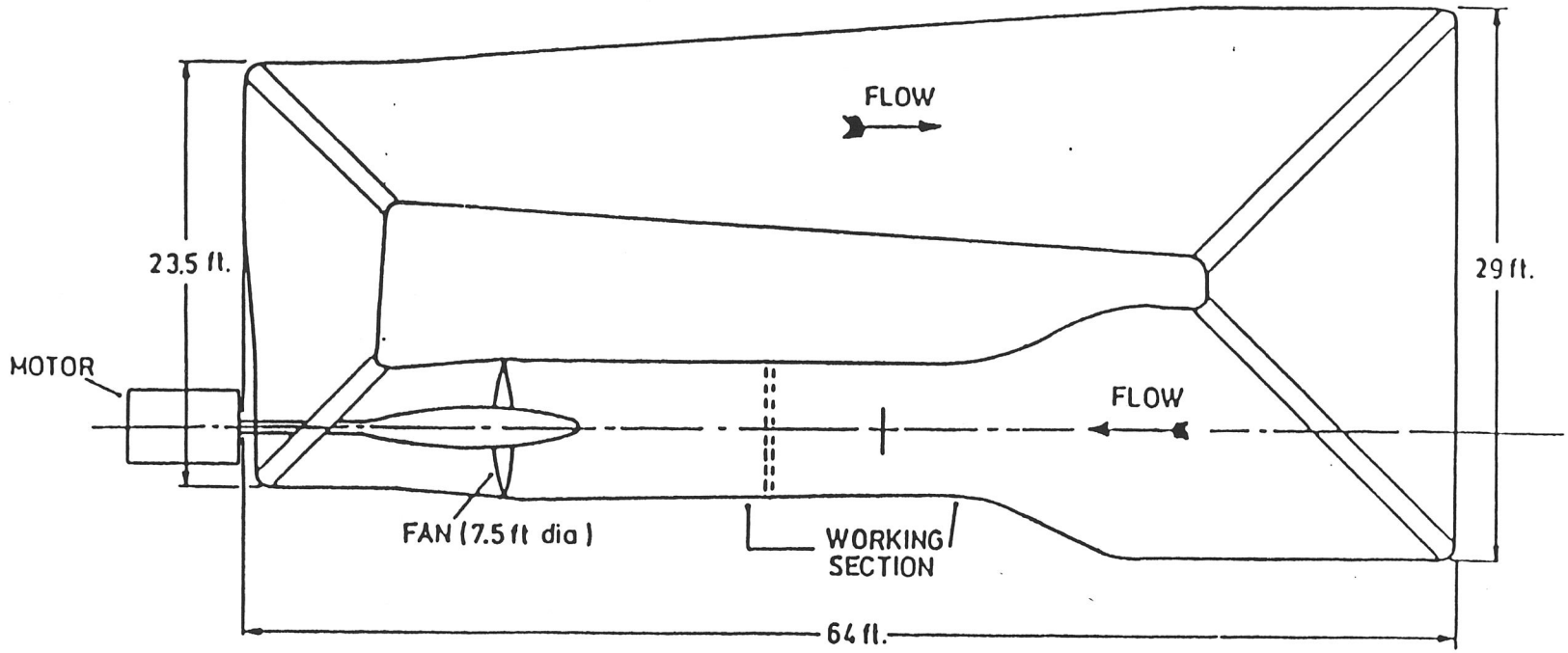
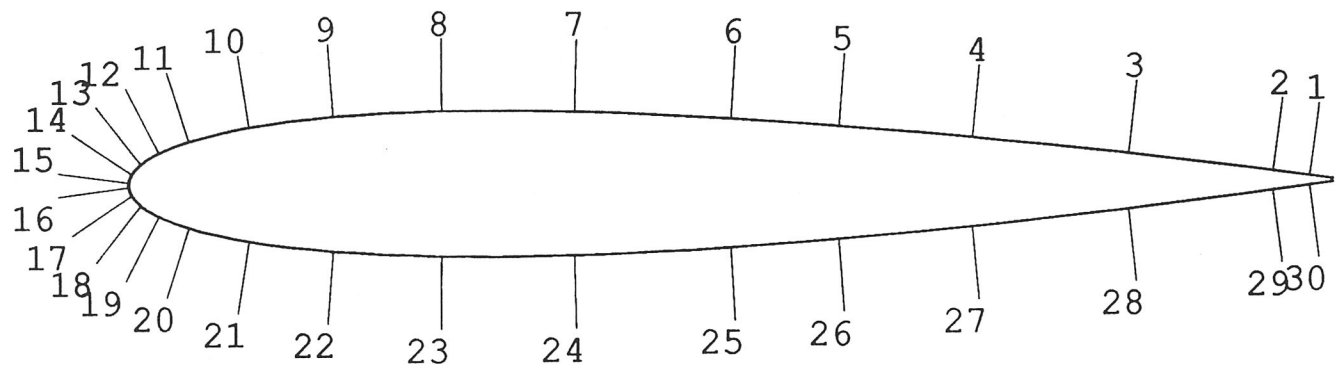


FIGURE 2 : PLAN VIEW OF THE GLASGOW UNIVERSITY "HANDLEY PAGE" 7ft X 5ft 3in WIND TUNNEL



X(1)/C = 0.98000	X(11)/C = 0.05000	X(21)/C = 0.10000
X(2)/C = 0.95000	X(12)/C = 0.02500	X(22)/C = 0.17000
X(3)/C = 0.83000	X(13)/C = 0.01000	X(23)/C = 0.26000
X(4)/C = 0.70000	X(14)/C = 0.00250	X(24)/C = 0.37000
X(5)/C = 0.59000	X(15)/C = 0.00025	X(25)/C = 0.50000
X(6)/C = 0.50000	X(16)/C = 0.00025	X(26)/C = 0.59000
X(7)/C = 0.37000	X(17)/C = 0.00250	X(27)/C = 0.70000
X(8)/C = 0.26000	X(18)/C = 0.01000	X(28)/C = 0.83000
X(9)/C = 0.17000	X(19)/C = 0.02500	X(29)/C = 0.95000
X(10)/C = 0.10000	X(20)/C = 0.05000	X(30)/C = 0.98000

FIGURE 3 : PRESSURE TRANSDUCER LOCATIONS FOR THE NACA 0012.

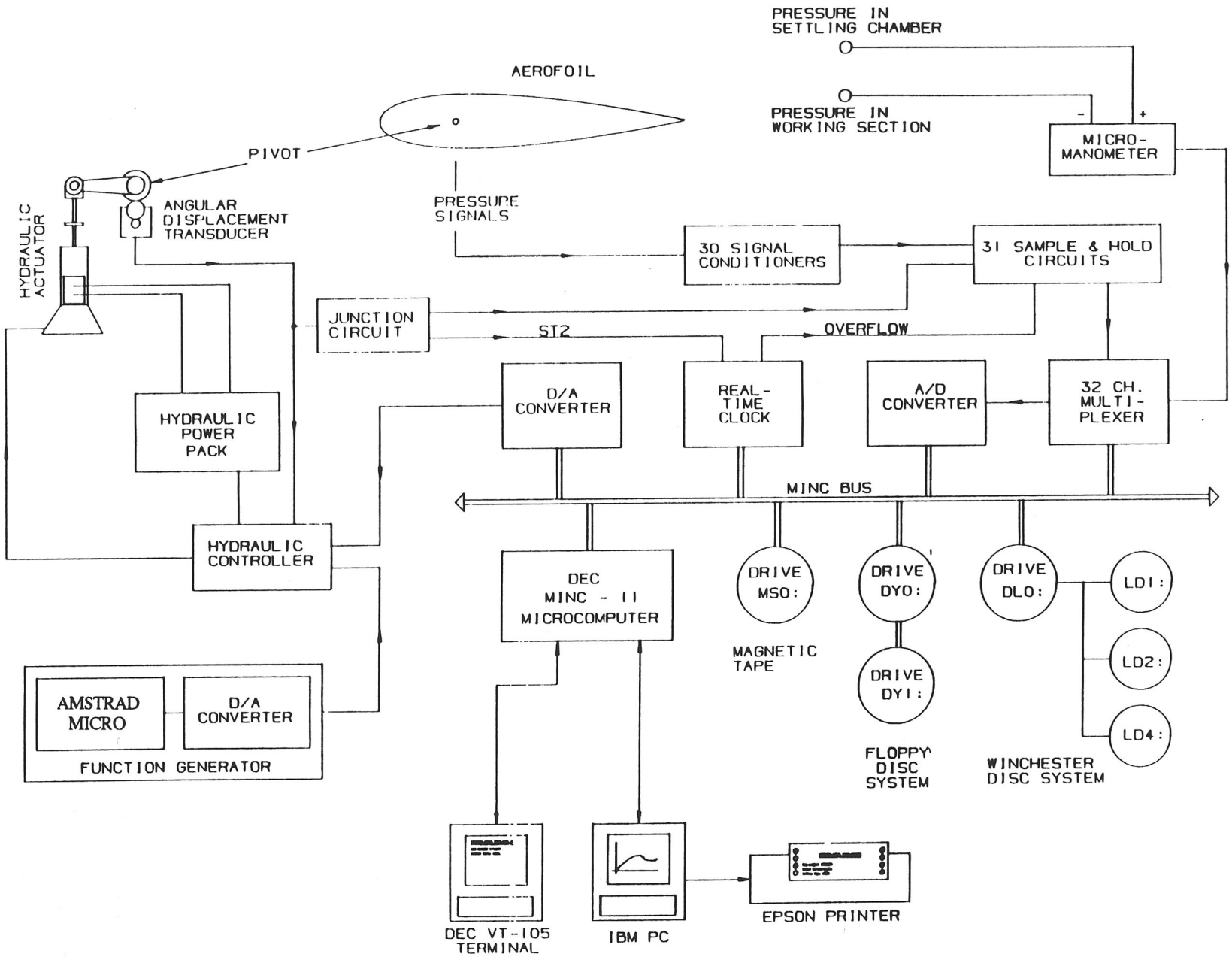


FIGURE 4 : SYSTEMATIC ARRANGEMENT OF DATA ACQUSITION AND CONTROL SYSTEM

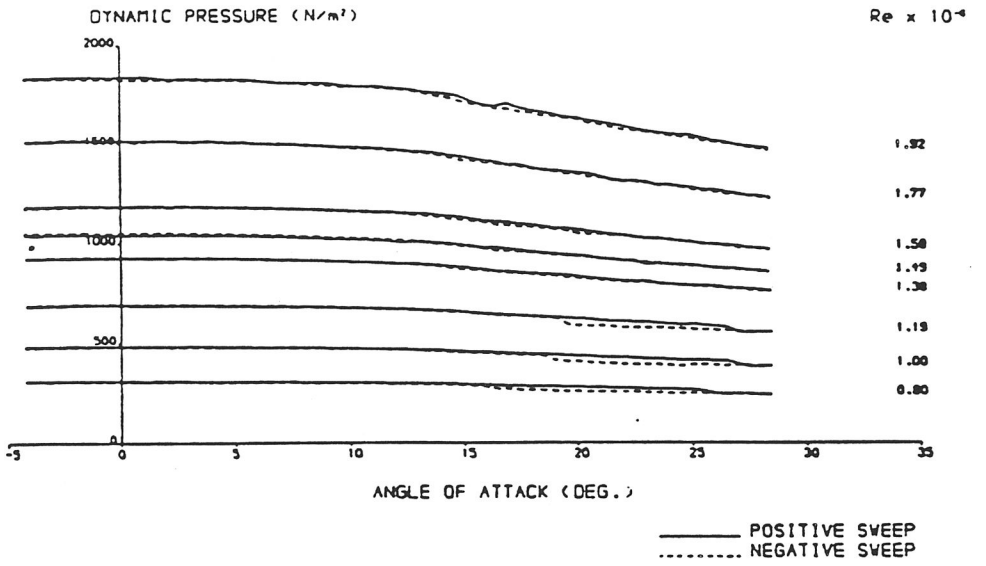


FIGURE 5 : REDUCTION OF DYNAMIC PRESSURE WITH INCREASING ANGLE OF ATTACK.

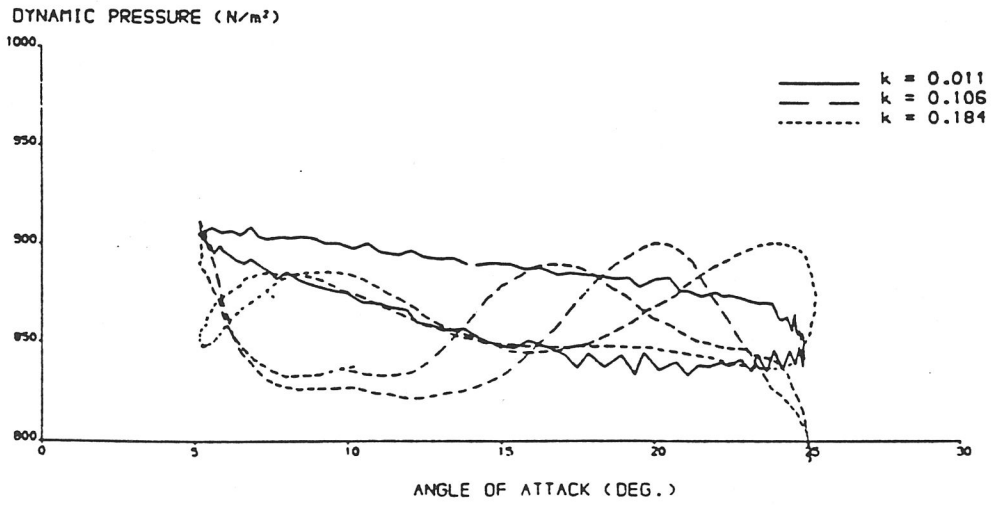


FIGURE 6 : VARIATION OF DYNAMIC PRESSURE DURING OSCILLATORY TESTS.

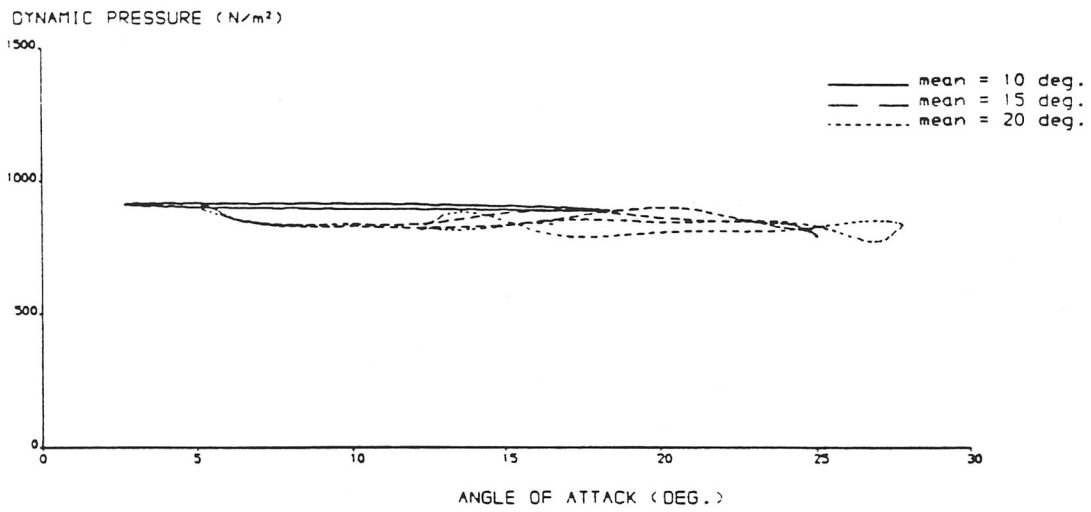


FIGURE 7 : VARIATION OF DYNAMIC PRESSURE FOR VARIOUS MEAN ANGLES OF ATTACK AT A REDUCED FREQUENCY OF 0.10.

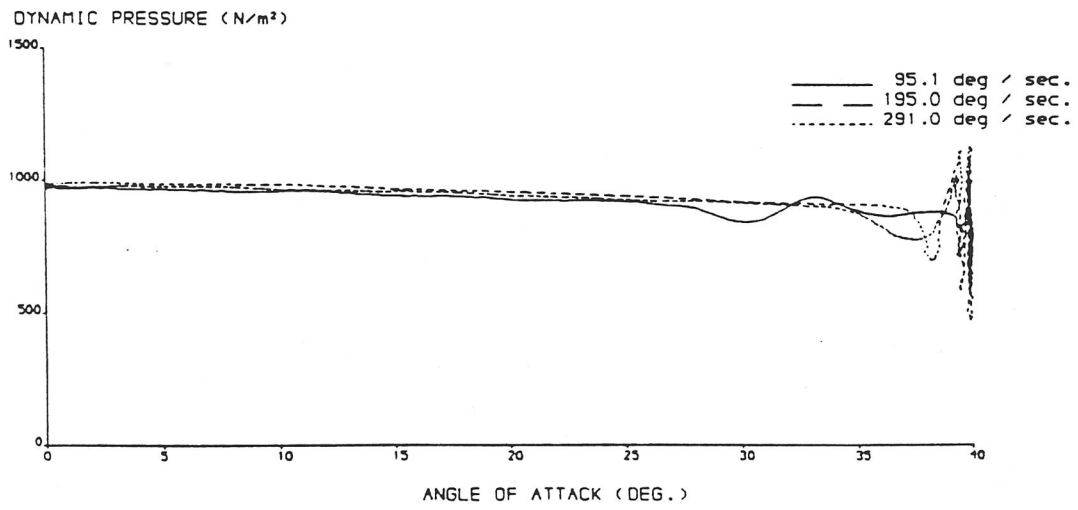


FIGURE 8 : VARIATION OF DYNAMIC PRESSURE FOR VARIOUS PITCH RATES DURING RAMP TESTS.

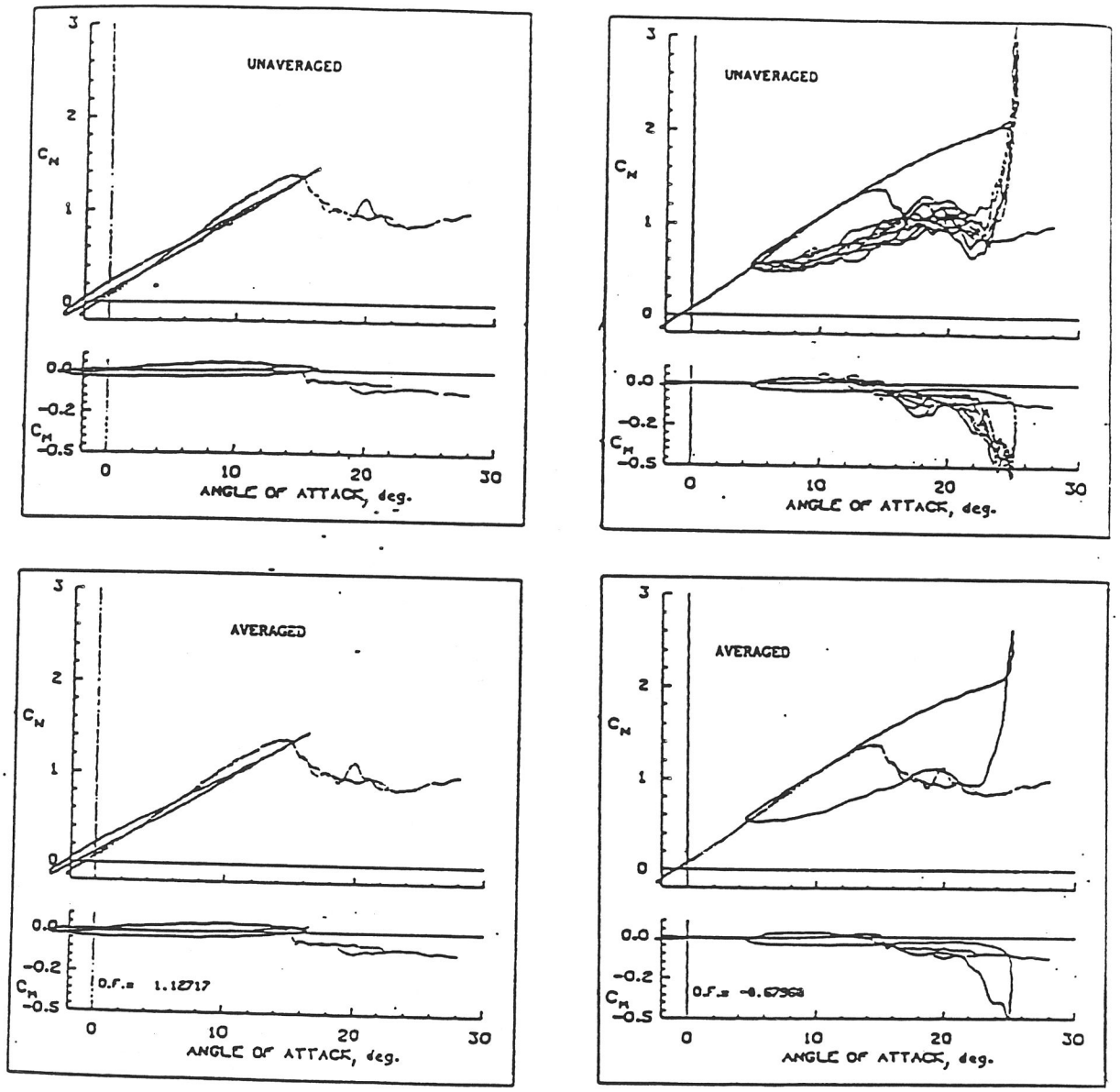


FIGURE 9: EFFECT OF AVERAGING ON THE NORMAL FORCE AND PITCHING MOMENT FOR OSCILLATORY TESTS.

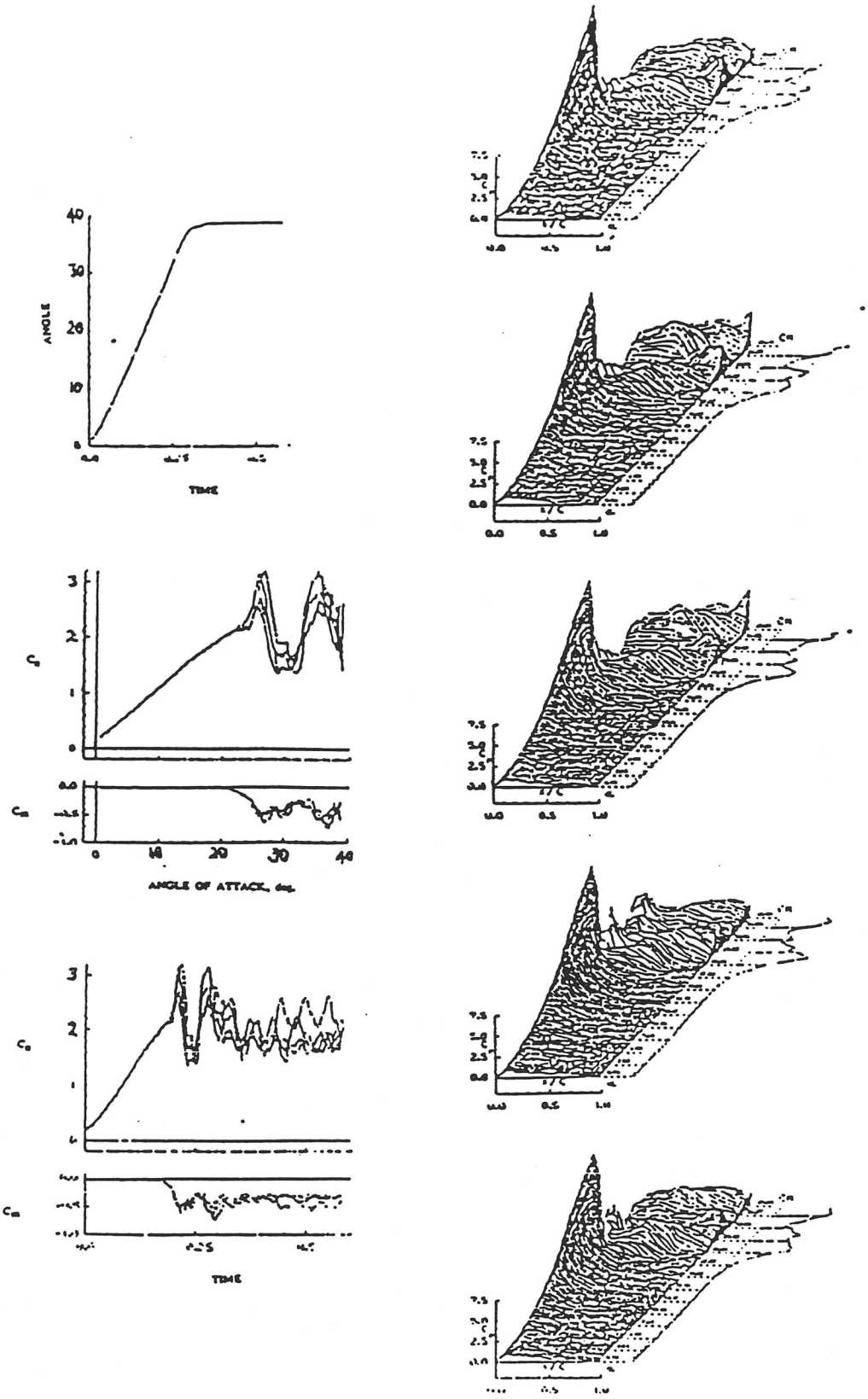


FIGURE 10: TYPICAL UNAVERAGED DATA FOR RAMP TESTS.

G.U. Aero Report 9207

UNIVERSITY OF GLASGOW

DEPARTMENT OF AEROSPACE ENGINEERING

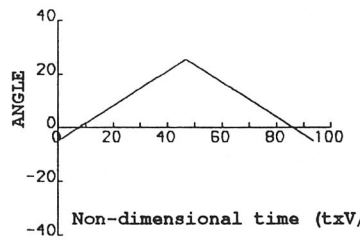
PRESSURE DATA FROM

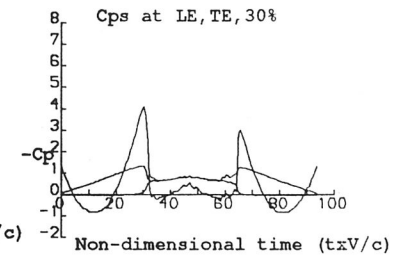
STATIC EXPERIMENTS

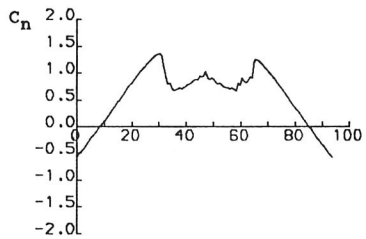
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

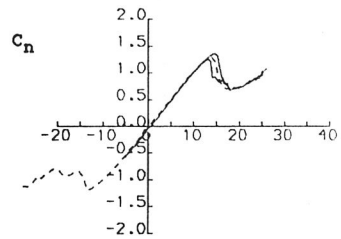
RUN REFERENCE NUMBER: 11
REYNOLDS NUMBER = 1524981.
DYNAMIC PRESSURE = 1004.08 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

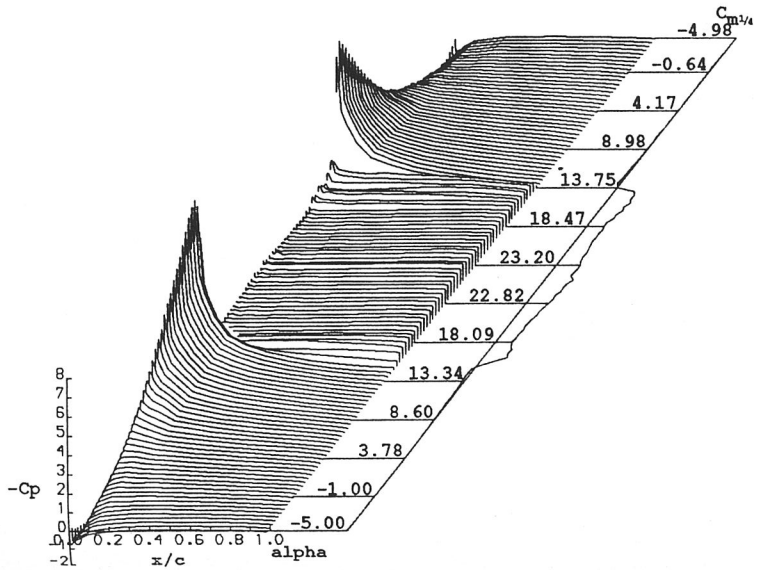
DATE OF TEST: 13/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 20.0°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

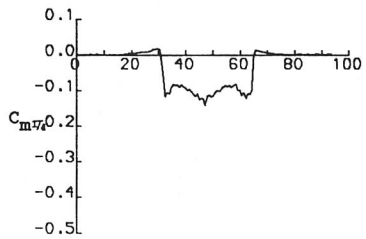


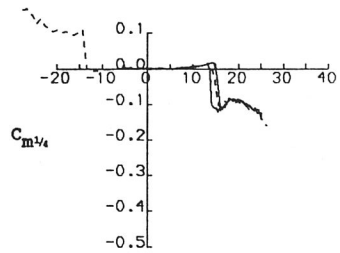


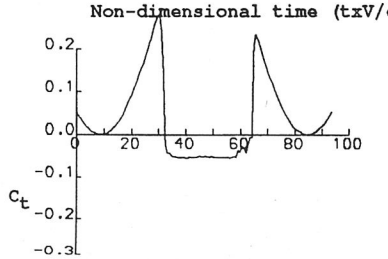


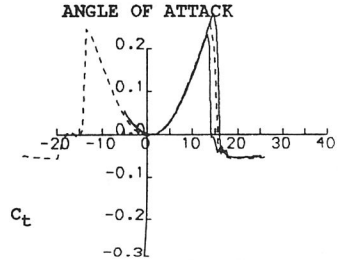








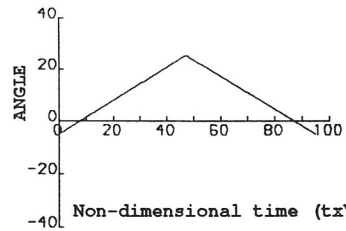


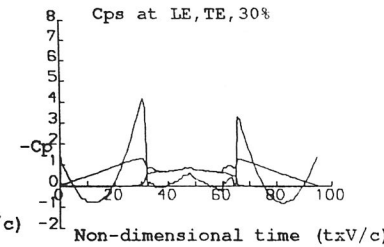


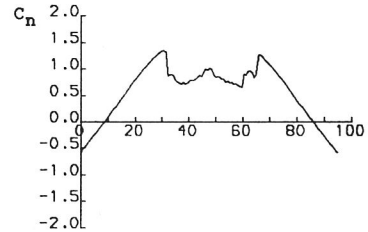
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

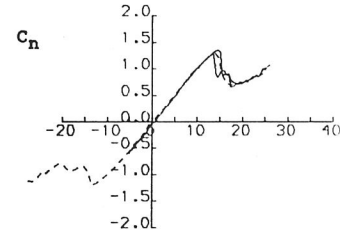
RUN REFERENCE NUMBER: 21
REYNOLDS NUMBER = 1530949.
DYNAMIC PRESSURE = 1023.53 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

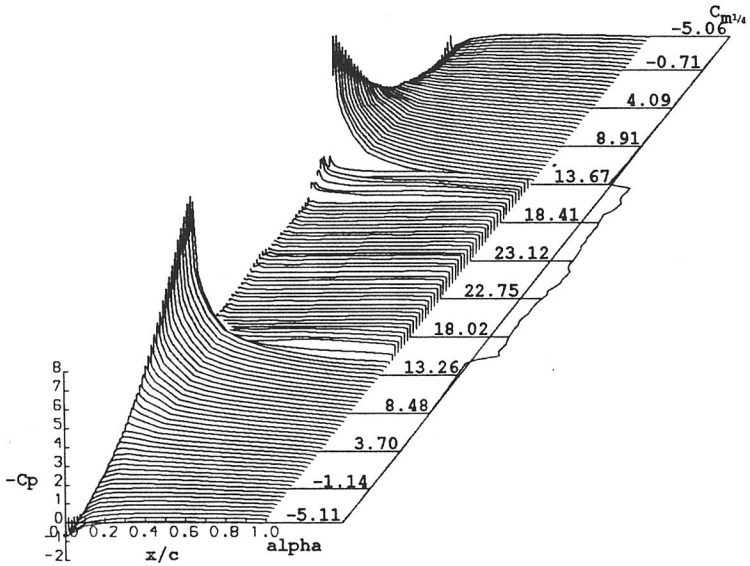
DATE OF TEST: 13/12/90
MACH NUMBER = 0.120
AIR TEMPERATURE = 21.3°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

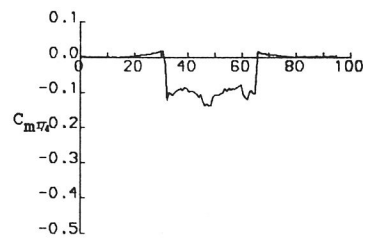


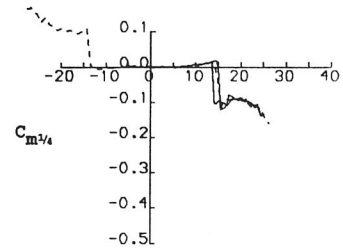


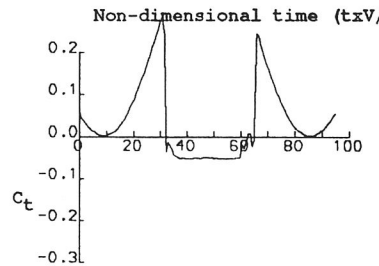


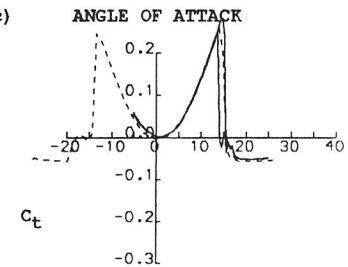








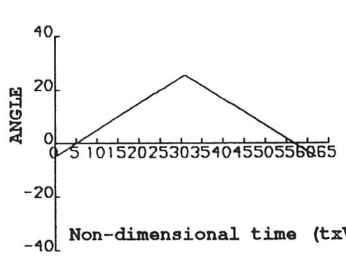


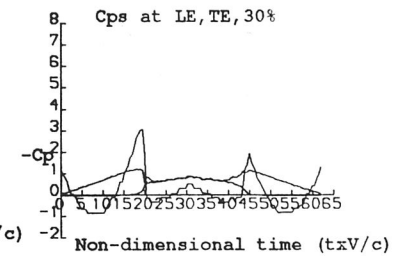


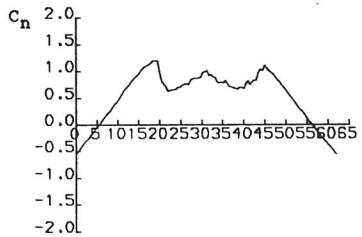
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

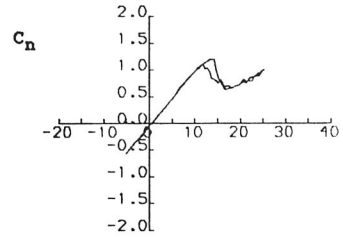
RUN REFERENCE NUMBER: 31
REYNOLDS NUMBER = 993418.
DYNAMIC PRESSURE = 435.11 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

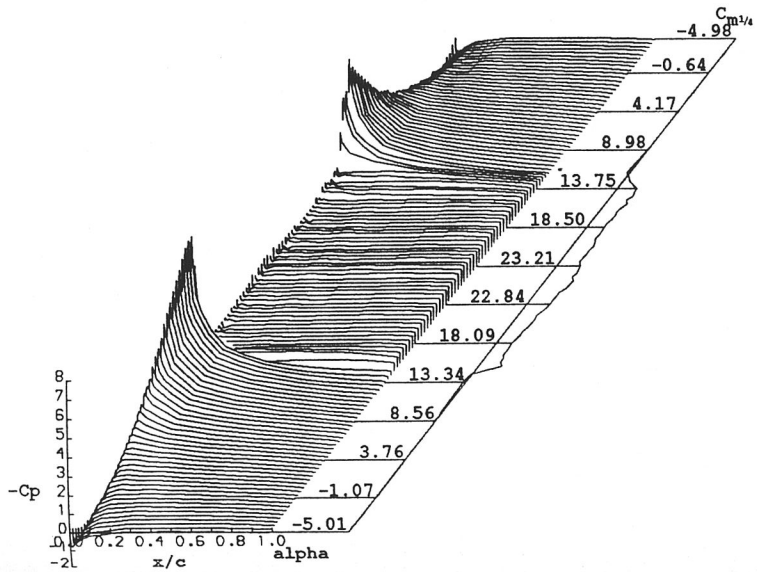
DATE OF TEST: 13/12/90
MACH NUMBER = 0.078
AIR TEMPERATURE = 22.4°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

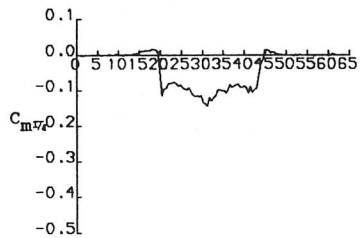


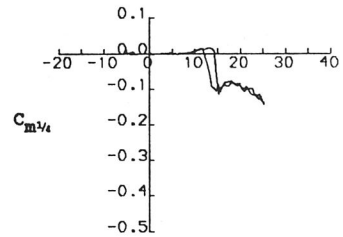


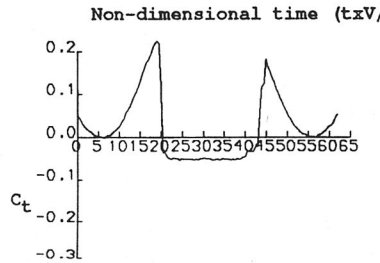


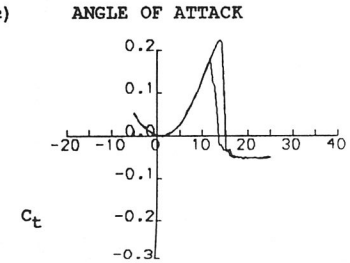






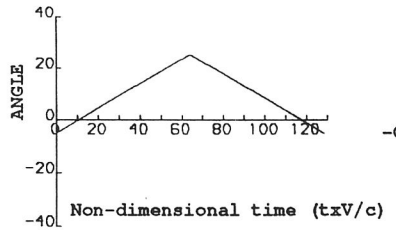


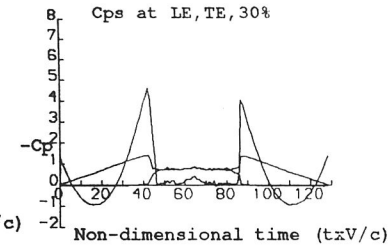


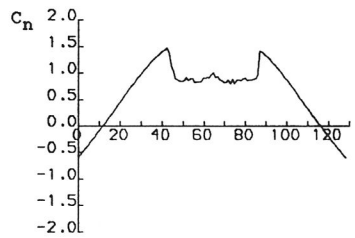


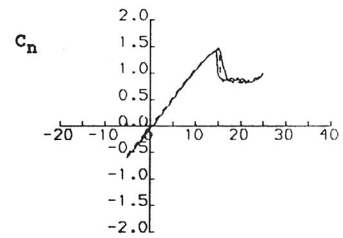
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

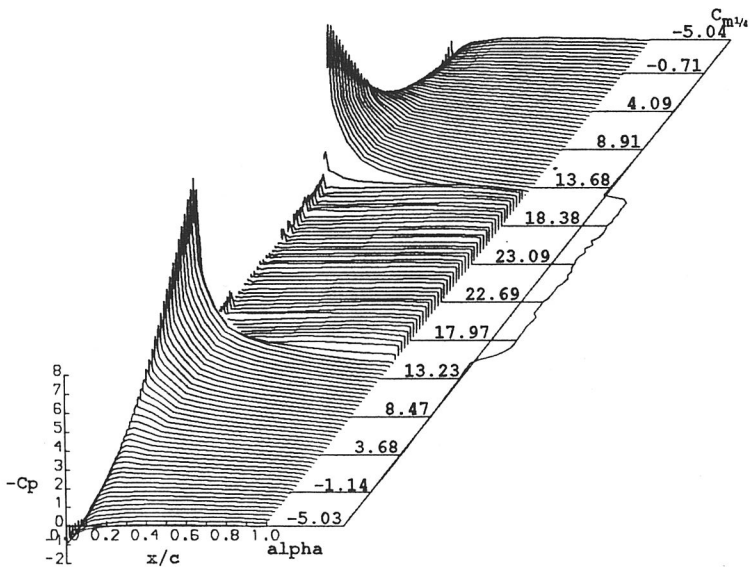
RUN REFERENCE NUMBER: 41
DATE OF TEST: 13/12/90
REYNOLDS NUMBER = 2050011.
MACH NUMBER = 0.161
DYNAMIC PRESSURE = 1862.56 Nm^{-2}
AIR TEMPERATURE = 23.0°C
NUMBER OF CYCLES = 1
SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC
AVERAGED DATA OF 1 CYCLES

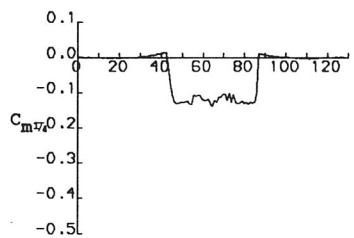


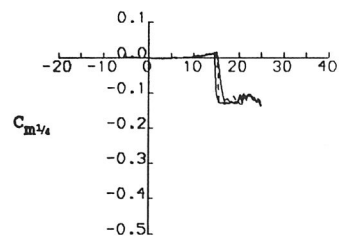


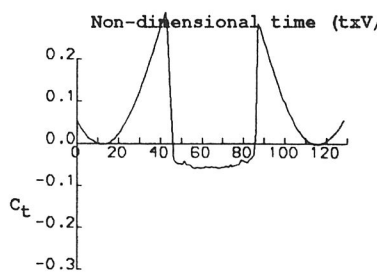


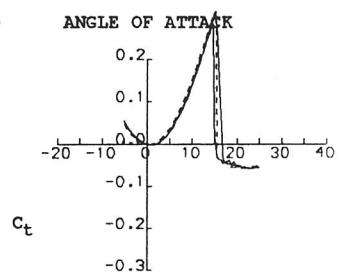








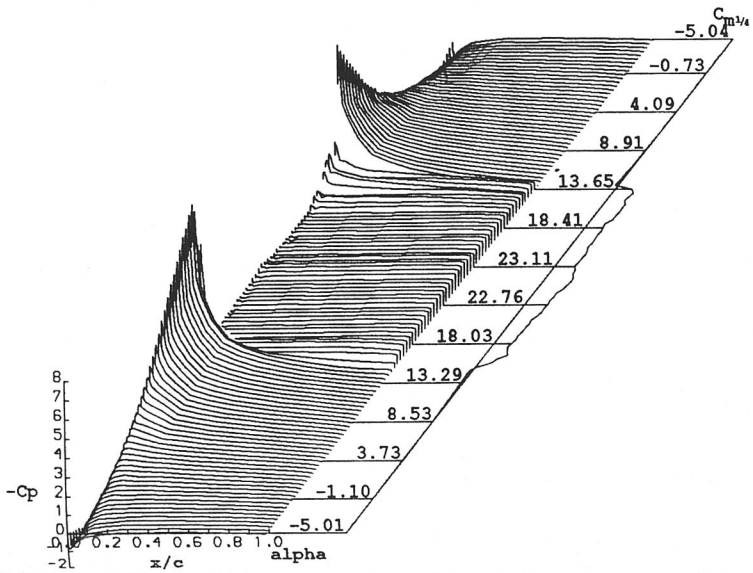


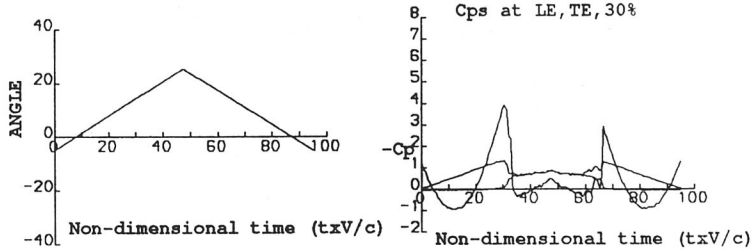


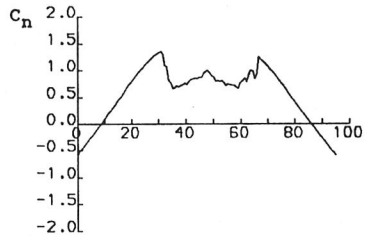
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

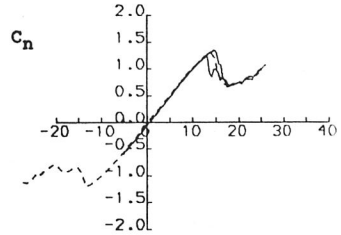
RUN REFERENCE NUMBER: 51
REYNOLDS NUMBER = 1515174.
DYNAMIC PRESSURE = 1020.12 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

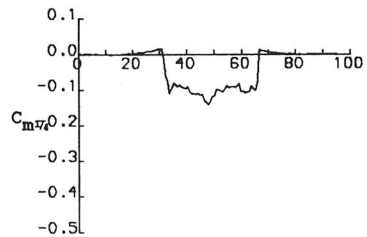
DATE OF TEST: 14/12/90
MACH NUMBER = 0.119
AIR TEMPERATURE = 23.3°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

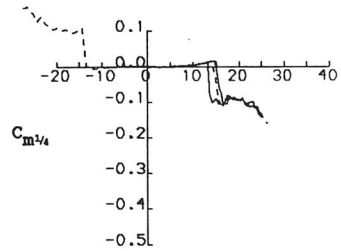


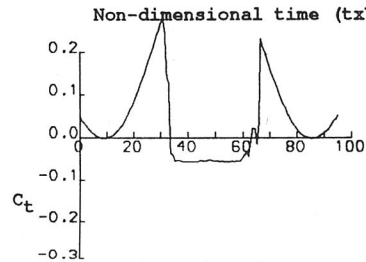


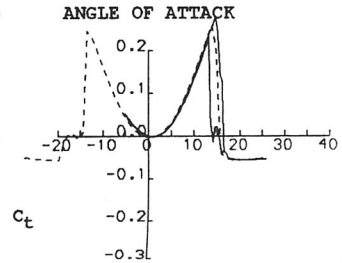






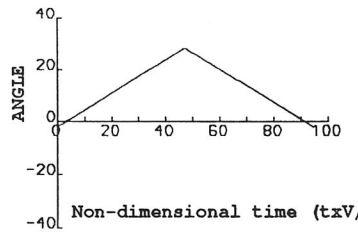


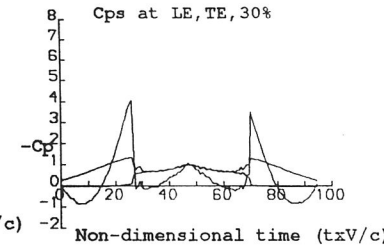


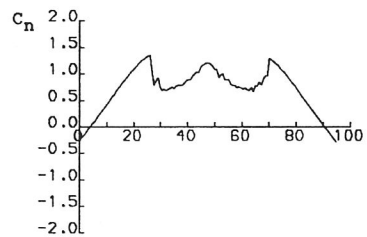


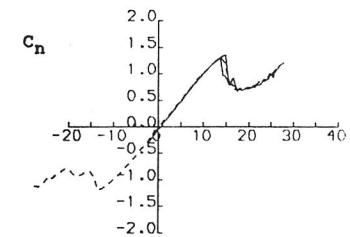
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

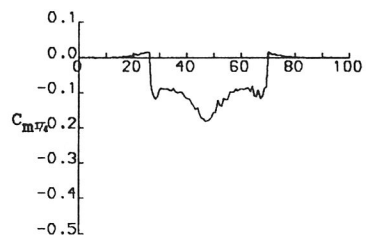
RUN REFERENCE NUMBER: 61
DATE OF TEST: 14/12/90
REYNOLDS NUMBER = 1505156.
MACH NUMBER = 0.119
DYNAMIC PRESSURE = 1011.91 Nm^{-2}
AIR TEMPERATURE = 23.9°C
NUMBER OF CYCLES = 1
SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC
AVERAGED DATA OF 1 CYCLES

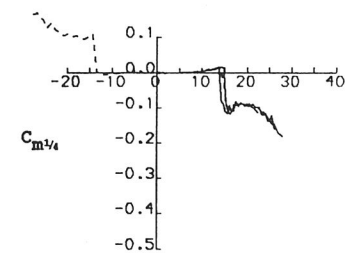


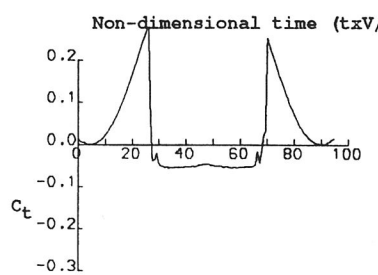


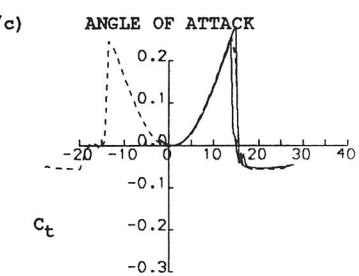


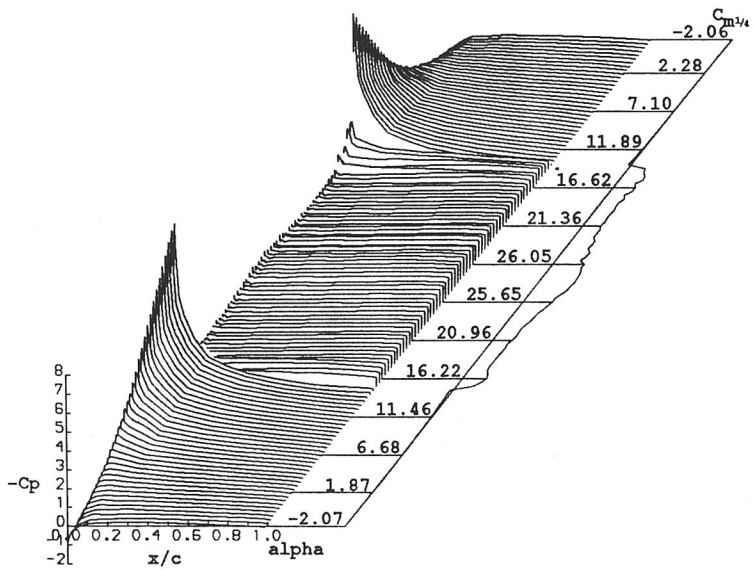








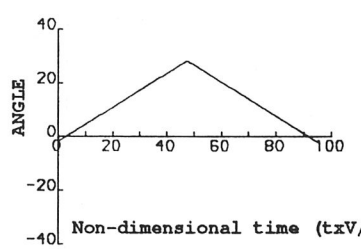


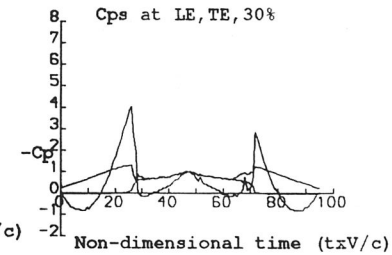


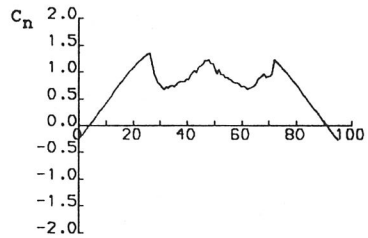
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

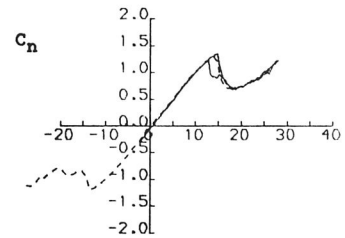
RUN REFERENCE NUMBER: 71
REYNOLDS NUMBER = 1509689.
DYNAMIC PRESSURE = 1018.02 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

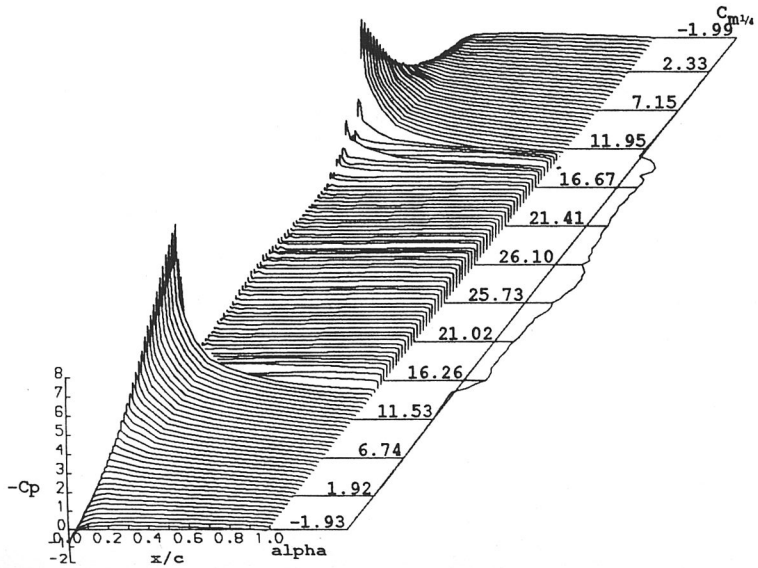
DATE OF TEST: 14/12/90
MACH NUMBER = 0.119
AIR TEMPERATURE = 23.9°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

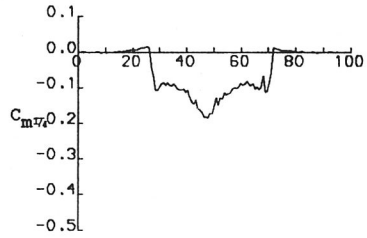


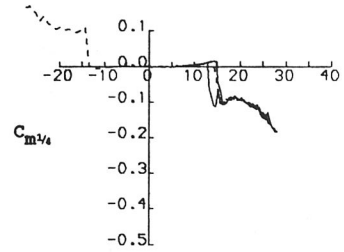


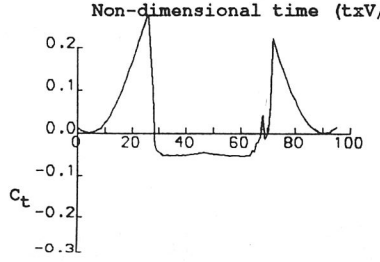


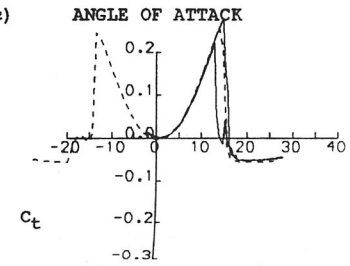






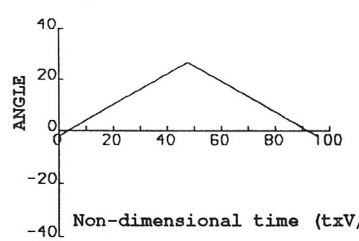


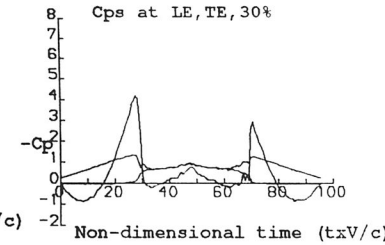


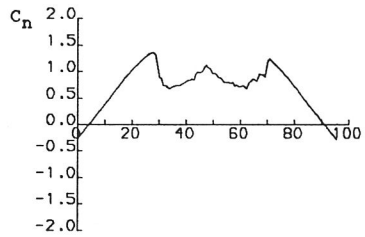


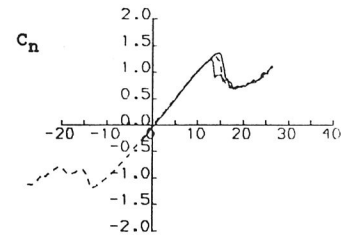
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

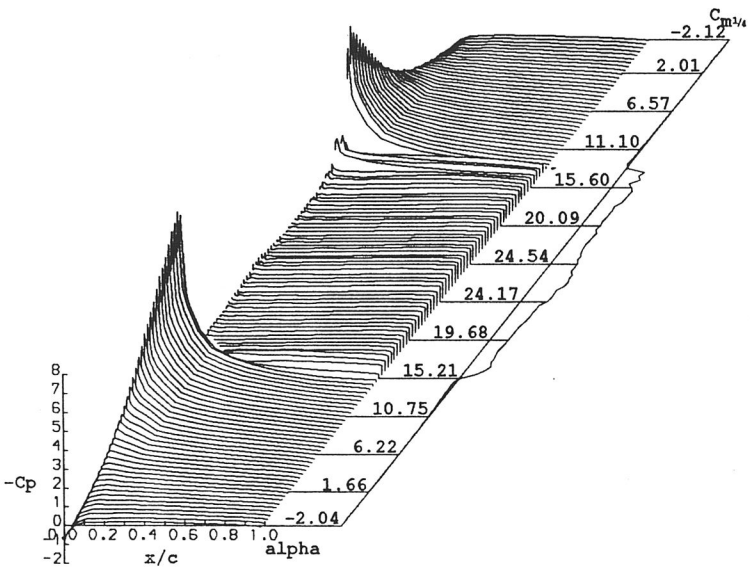
RUN REFERENCE NUMBER: 221
DATE OF TEST: 17/12/90
REYNOLDS NUMBER = 1551252.
MACH NUMBER = 0.120
DYNAMIC PRESSURE = 1043.48 Nm^{-2}
AIR TEMPERATURE = 21.0°C
NUMBER OF CYCLES = 1
SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC
AVERAGED DATA OF 1 CYCLES

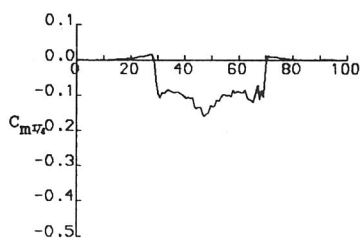


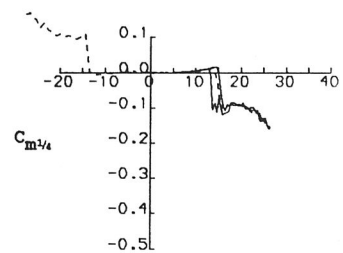


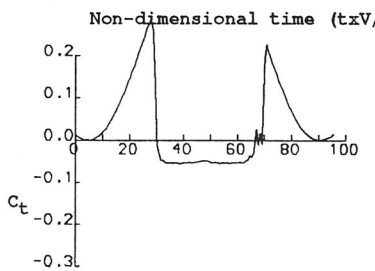


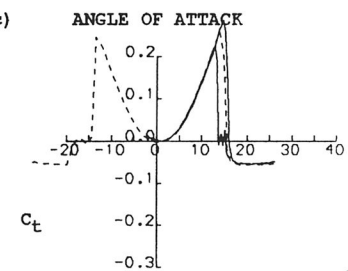








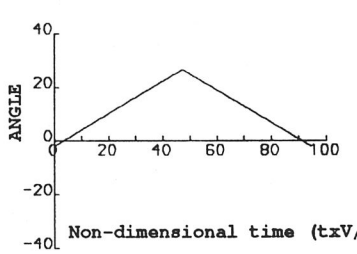


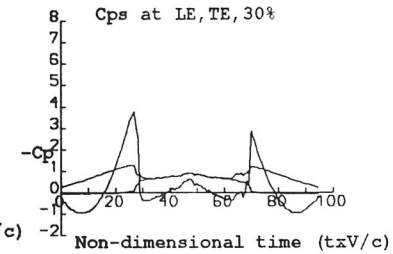


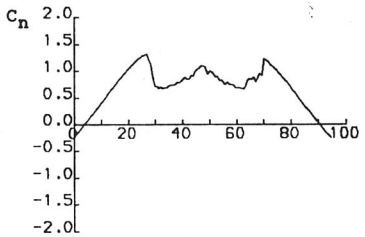
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

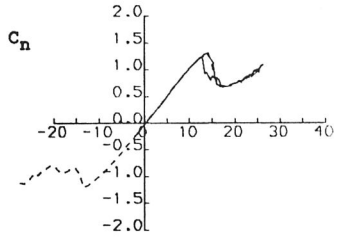
RUN REFERENCE NUMBER: 851
REYNOLDS NUMBER = 1472072.
DYNAMIC PRESSURE = 995.51 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

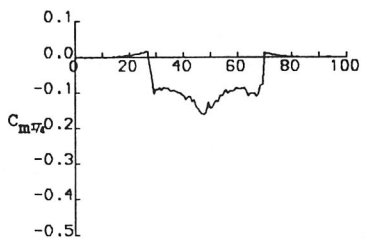
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 26.9°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

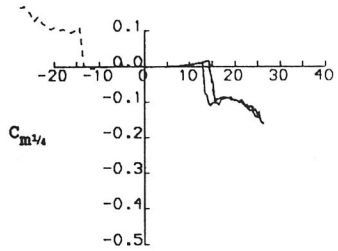


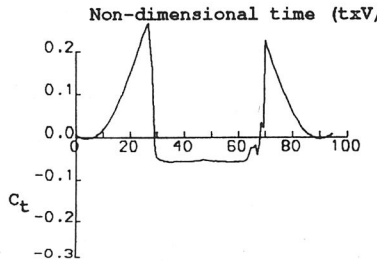


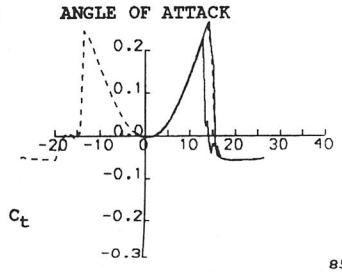


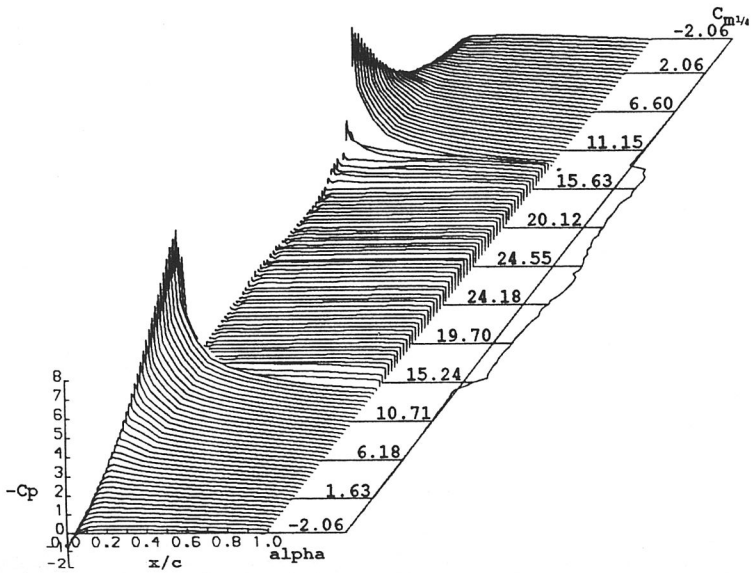








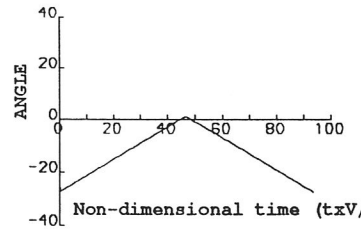


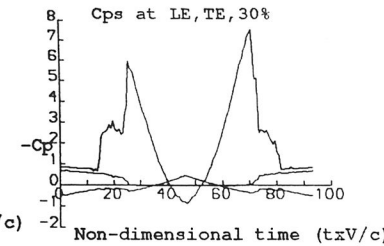


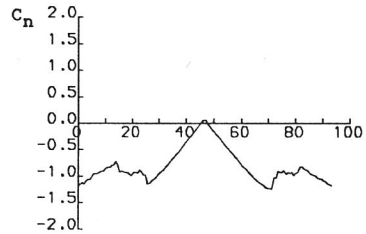
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

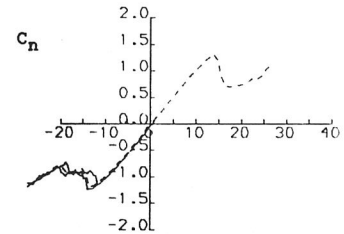
RUN REFERENCE NUMBER: 861
REYNOLDS NUMBER = 1522298.
DYNAMIC PRESSURE = 997.50 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

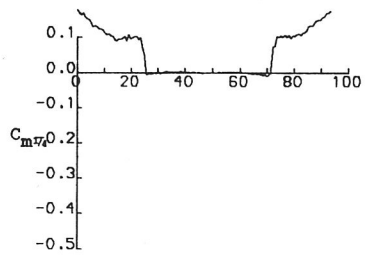
DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 19.6°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

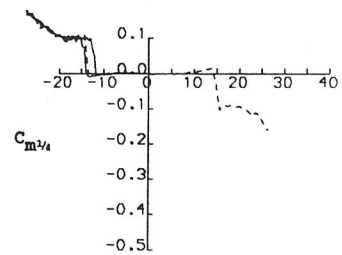


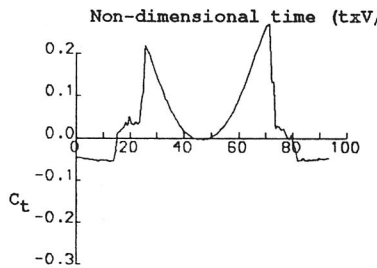


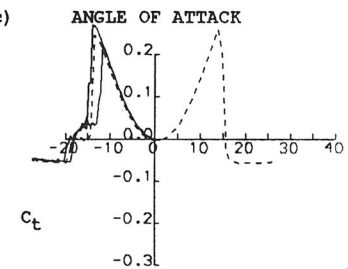


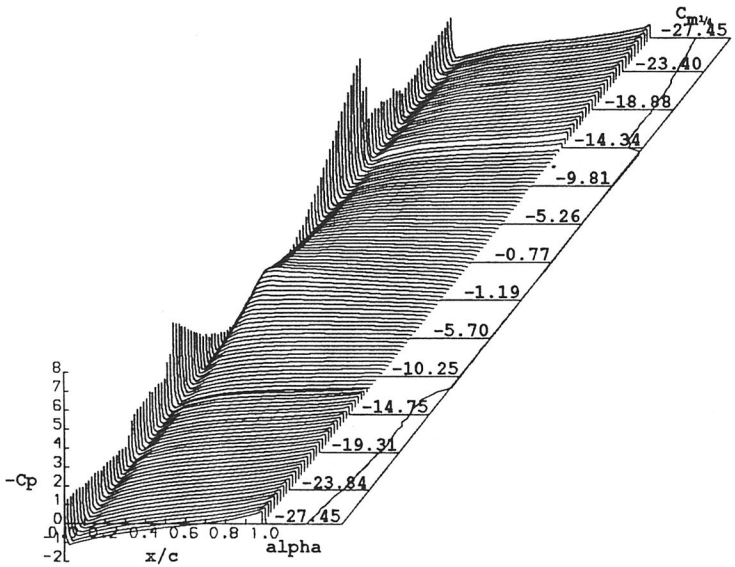








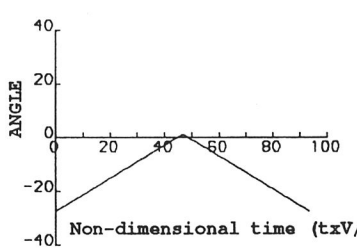


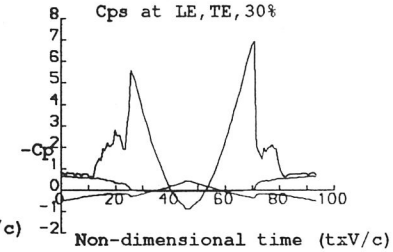


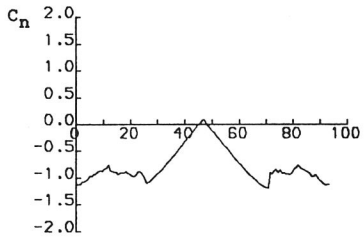
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

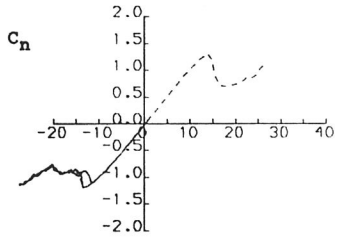
RUN REFERENCE NUMBER: 1341
REYNOLDS NUMBER = 1423809.
DYNAMIC PRESSURE = 962.38 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

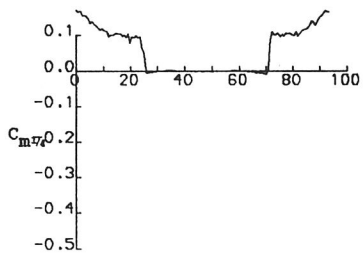
DATE OF TEST: 19/12/90
MACH NUMBER = 0.116
AIR TEMPERATURE = 31.0°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

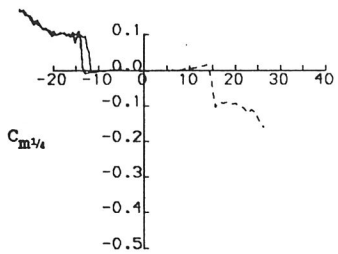


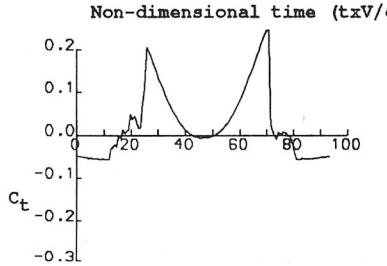


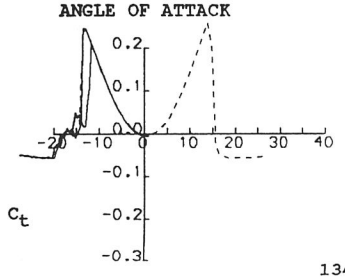


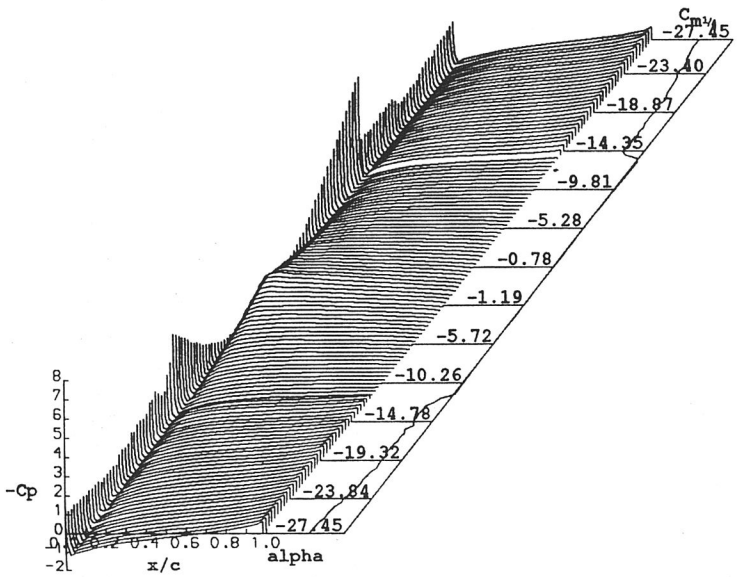








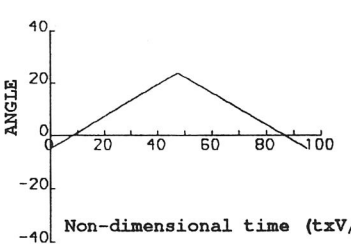


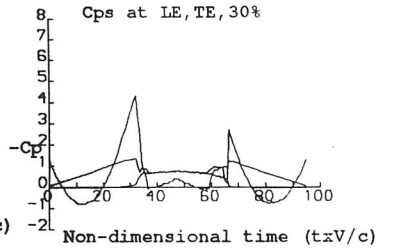


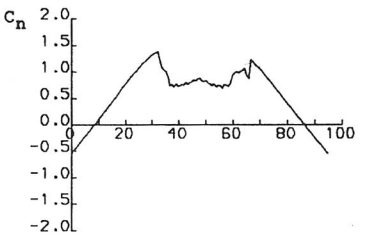
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

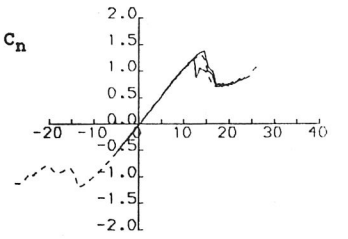
RUN REFERENCE NUMBER: 1351
REYNOLDS NUMBER = 1536844.
DYNAMIC PRESSURE = 1024.28 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

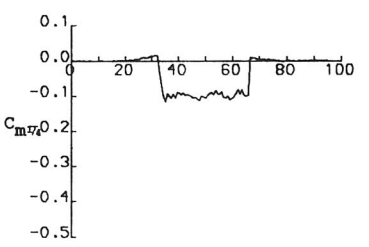
DATE OF TEST: 16/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 19.9°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

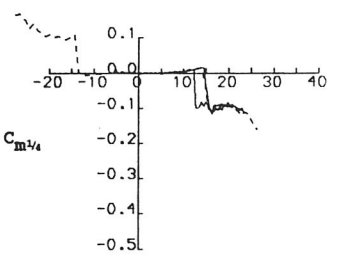


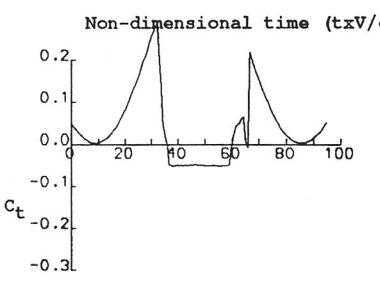


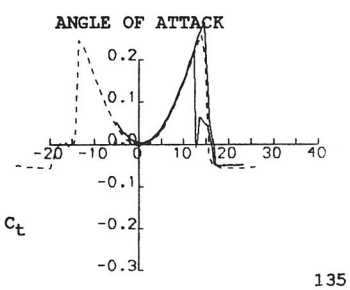


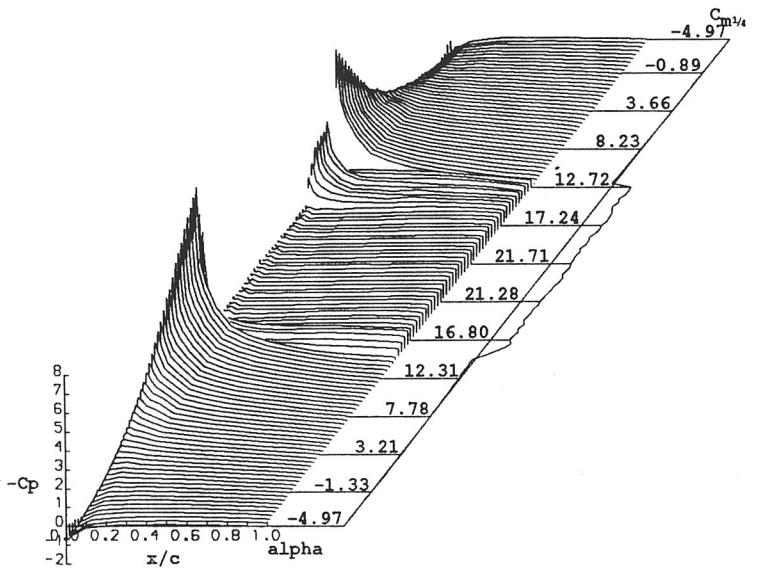








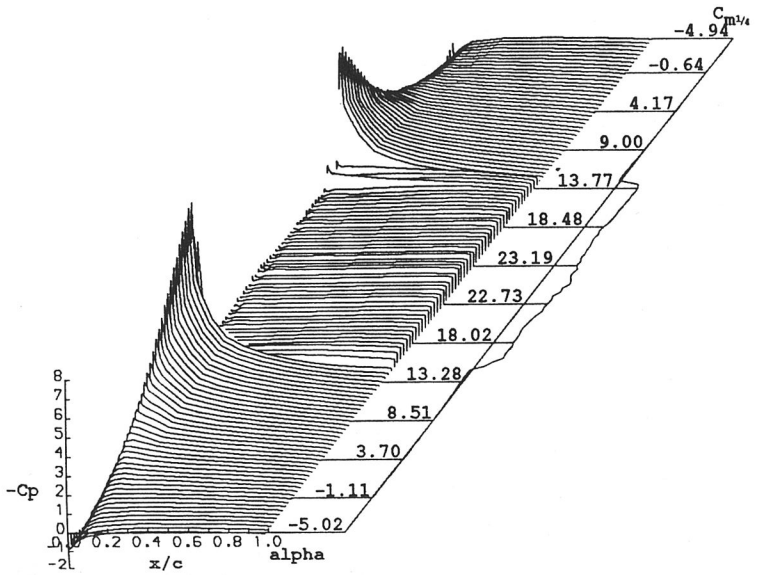


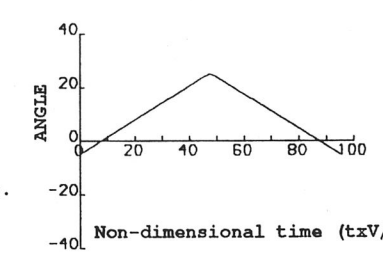


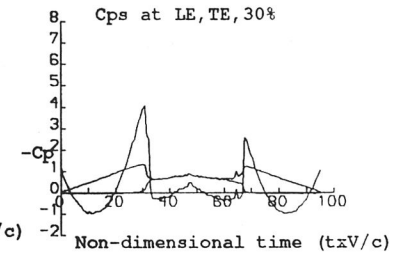
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

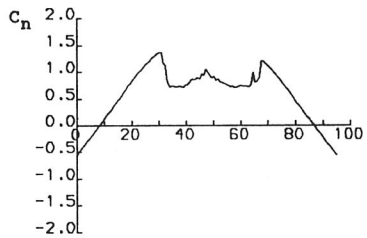
RUN REFERENCE NUMBER: 1731
REYNOLDS NUMBER = 1519049.
DYNAMIC PRESSURE = 1016.13 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

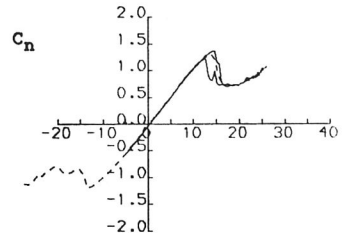
DATE OF TEST: 17/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 20.3°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

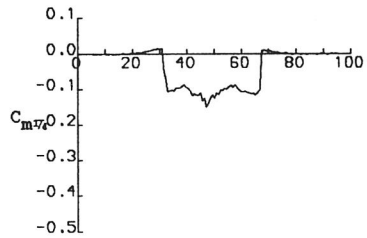


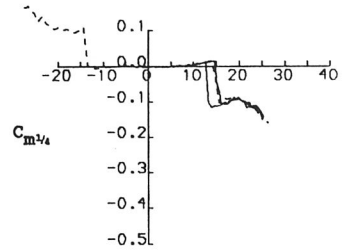


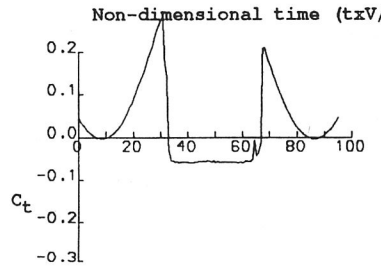


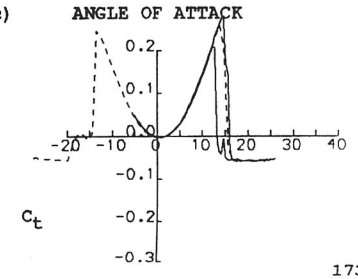








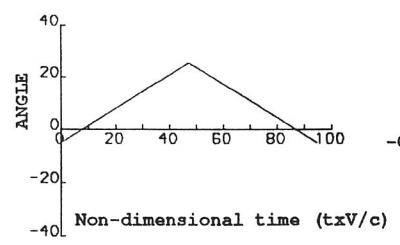


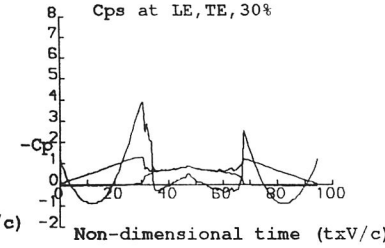


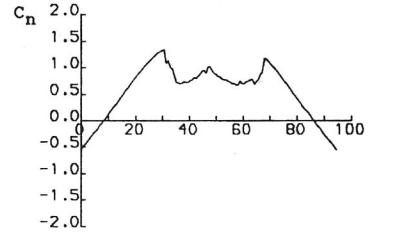
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

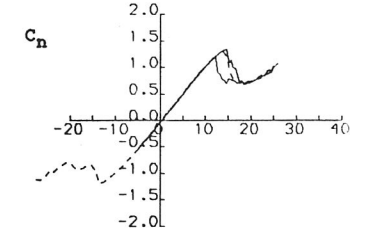
RUN REFERENCE NUMBER: 1741
REYNOLDS NUMBER = 1461236.
DYNAMIC PRESSURE = 986.99 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

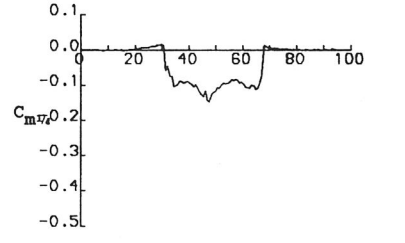
DATE OF TEST: 17/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.9°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

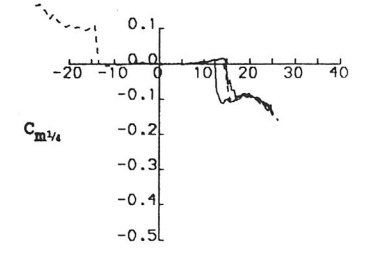


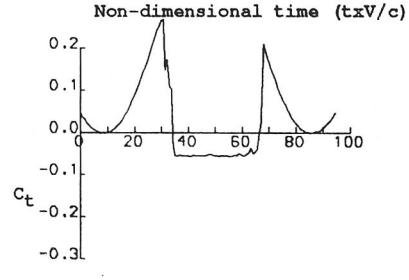


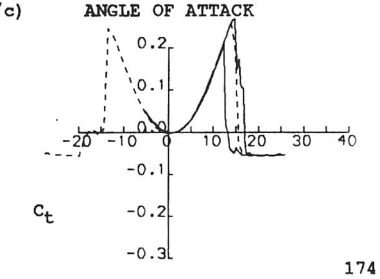


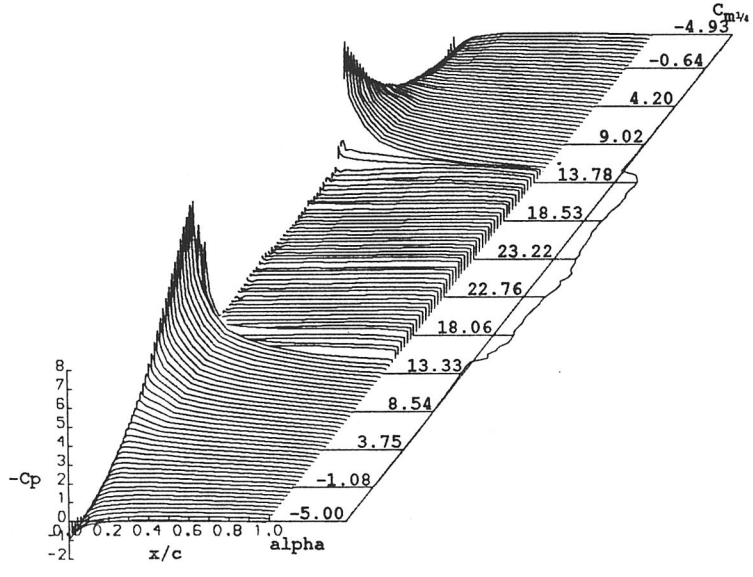








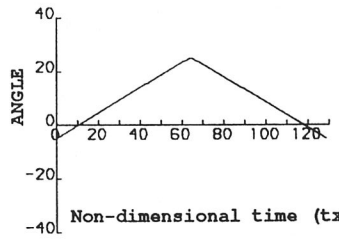


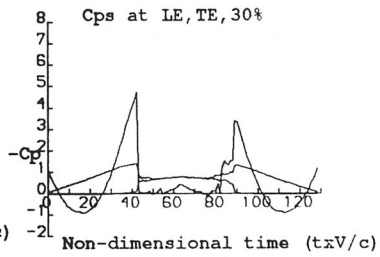


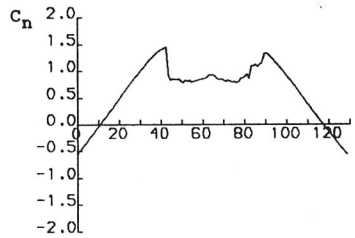
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

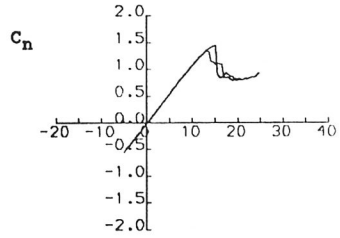
RUN REFERENCE NUMBER: 1751
REYNOLDS NUMBER = 1972953.
DYNAMIC PRESSURE = 1814.77 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

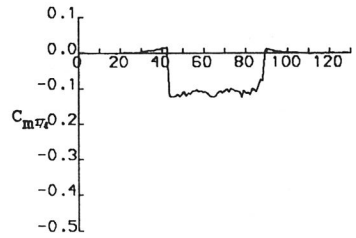
DATE OF TEST: 17/1/91
MACH NUMBER = 0.161
AIR TEMPERATURE = 26.9°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

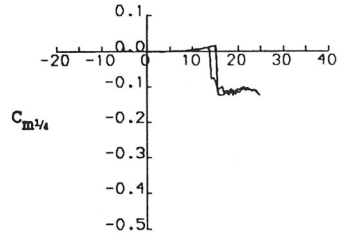


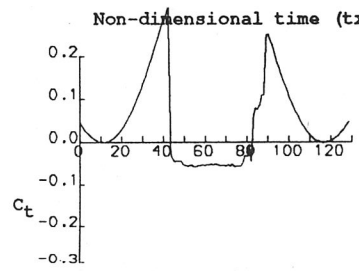


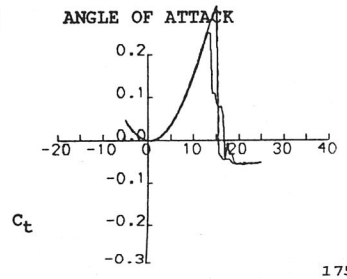


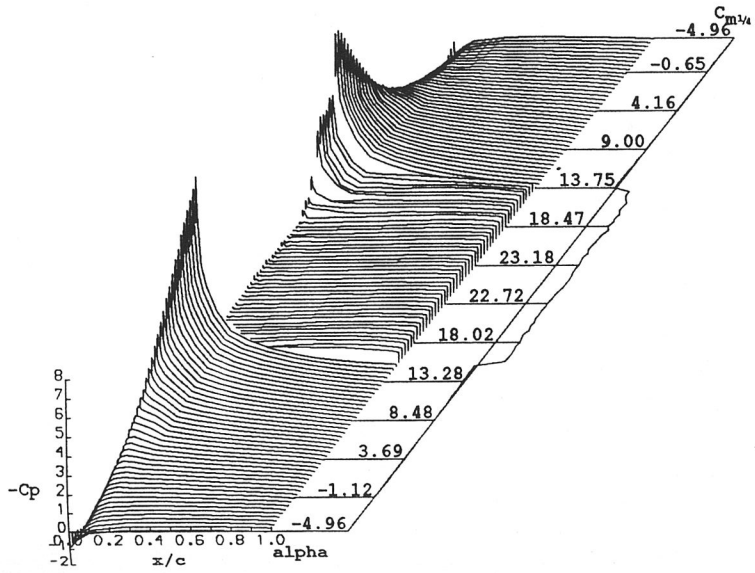








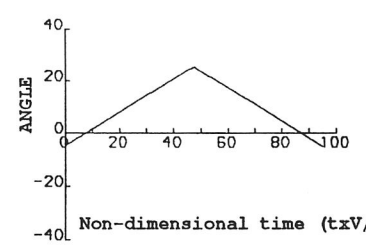


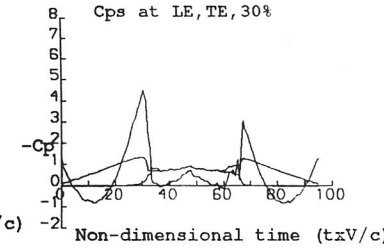


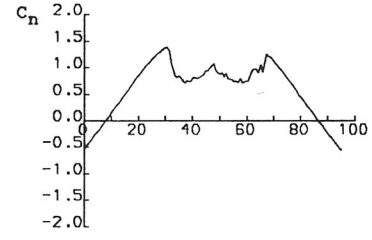
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

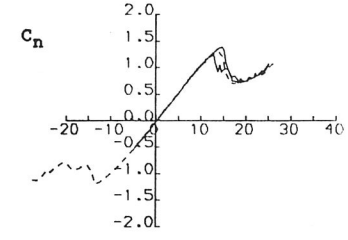
RUN REFERENCE NUMBER: 1761
REYNOLDS NUMBER = 1569713.
DYNAMIC PRESSURE = 1047.31 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

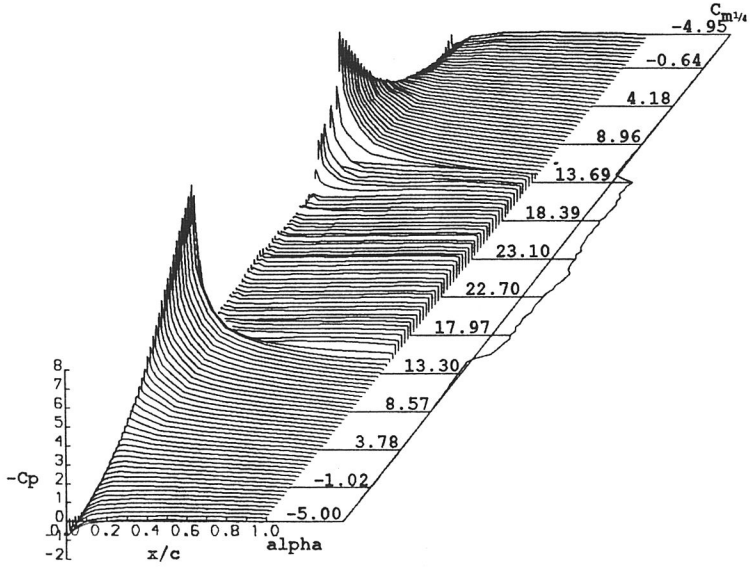
DATE OF TEST: 22/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 20.1°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

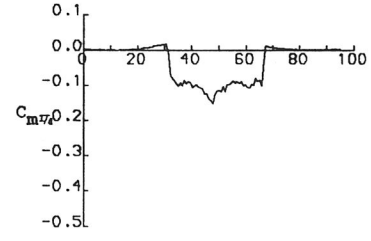


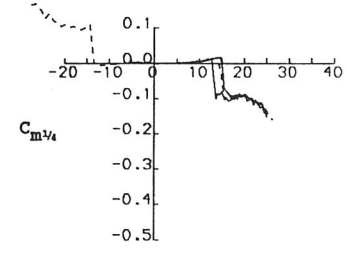


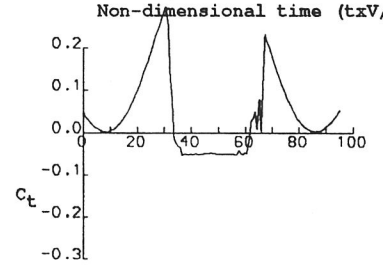


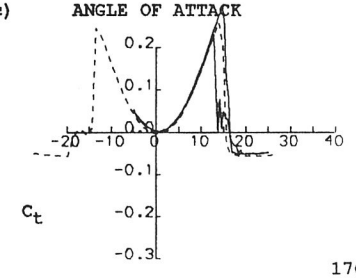








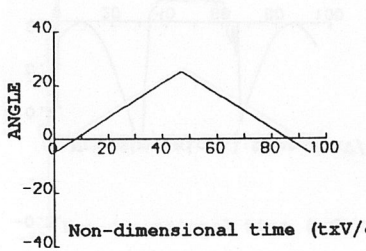


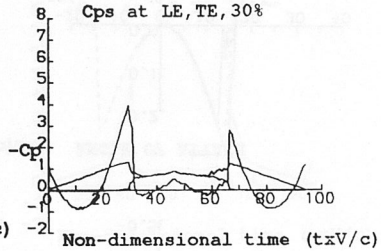


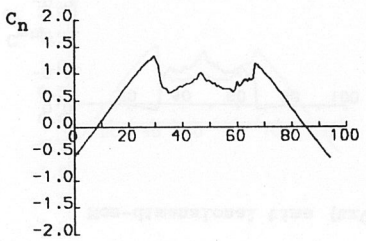
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

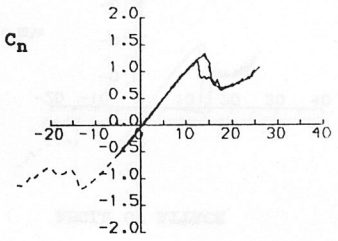
RUN REFERENCE NUMBER: 1851
REYNOLDS NUMBER = 1510073.
DYNAMIC PRESSURE = 1009.47 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

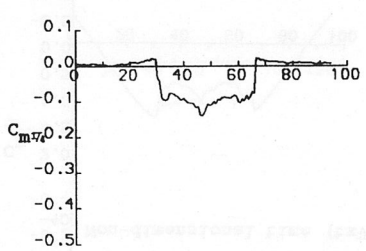
DATE OF TEST: 22/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.5°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

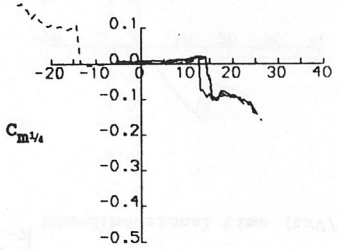


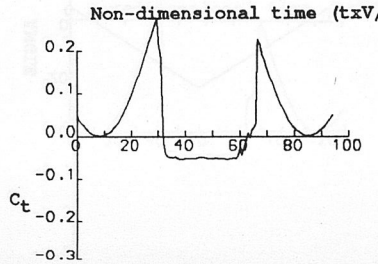


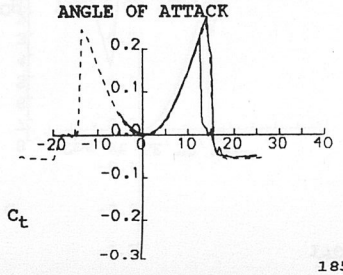


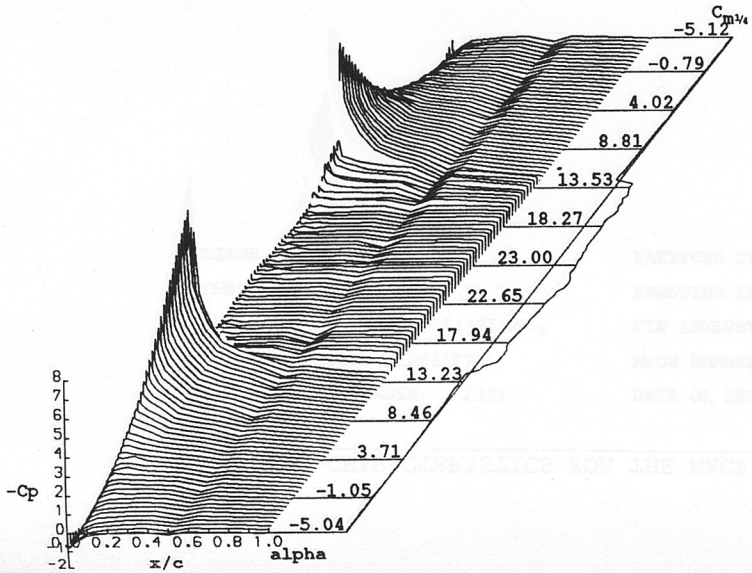






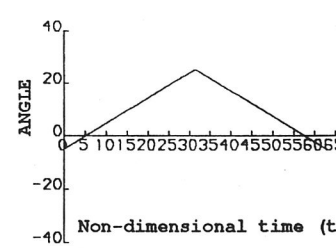


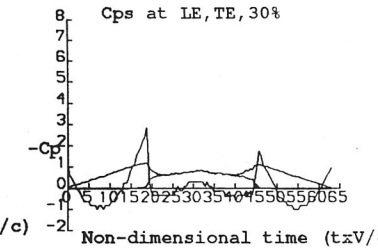


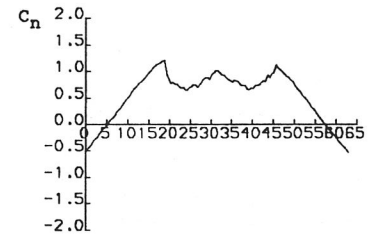


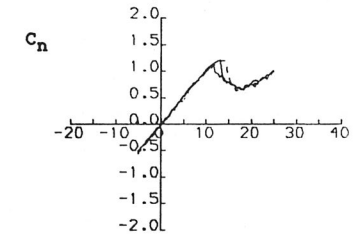
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

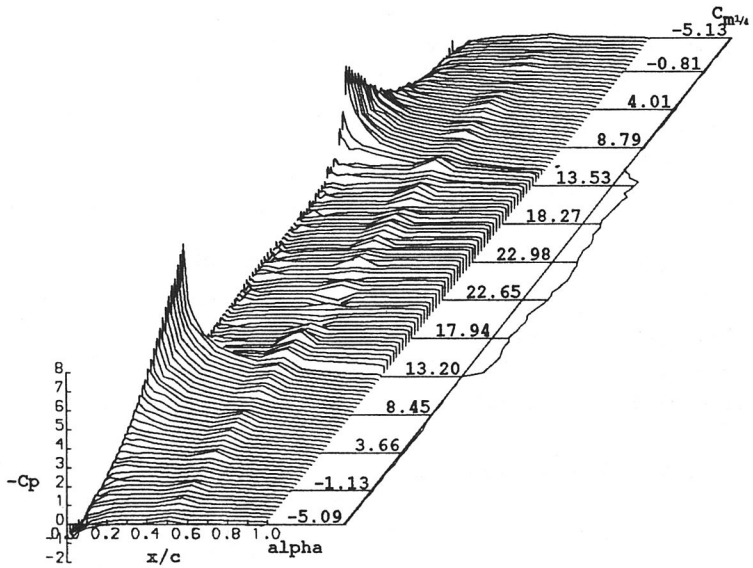
RUN REFERENCE NUMBER: 1861
DATE OF TEST: 22/1/91
REYNOLDS NUMBER = 1008088.
MACH NUMBER = 0.079
DYNAMIC PRESSURE = 452.21 Nm^{-2}
AIR TEMPERATURE = 25.1°C
NUMBER OF CYCLES = 1
SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC
AVERAGED DATA OF 1 CYCLES

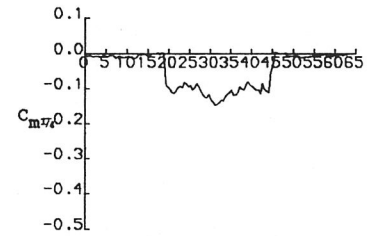


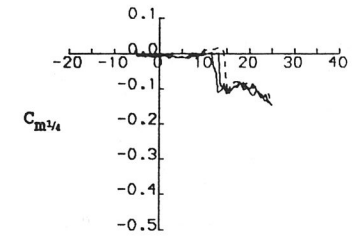


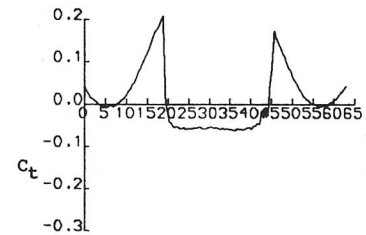


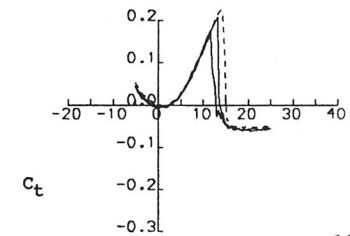








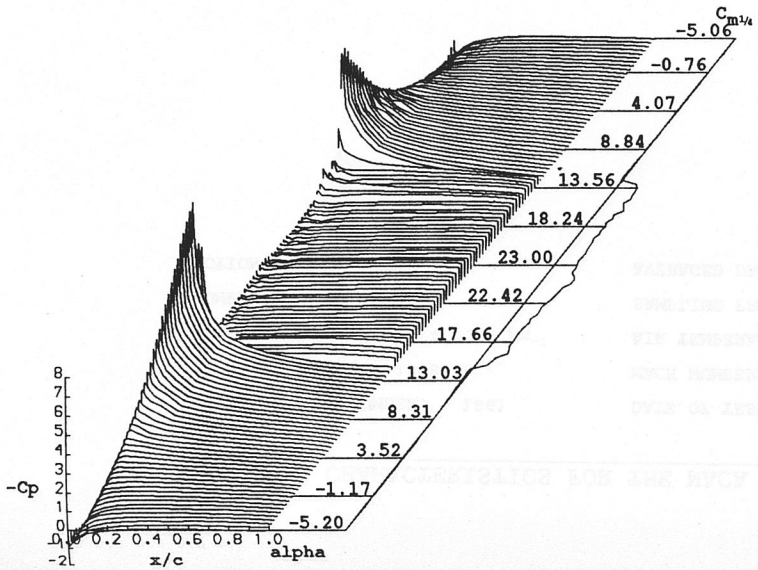


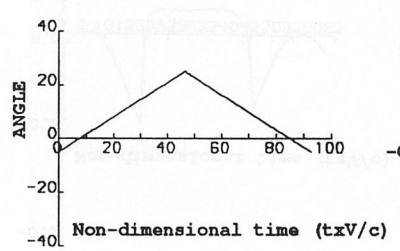


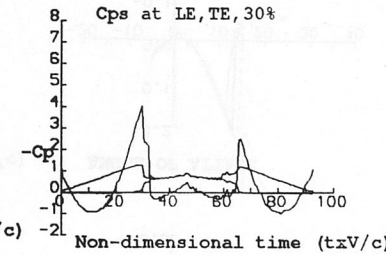
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

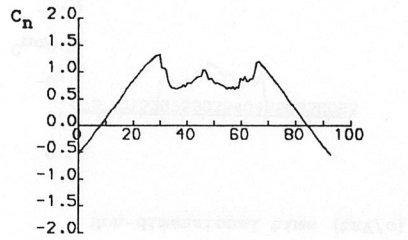
RUN REFERENCE NUMBER: 1951
REYNOLDS NUMBER = 1502121.
DYNAMIC PRESSURE = 984.37 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

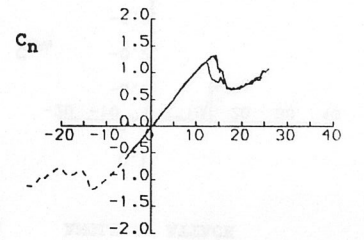
DATE OF TEST: 23/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 22.4°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

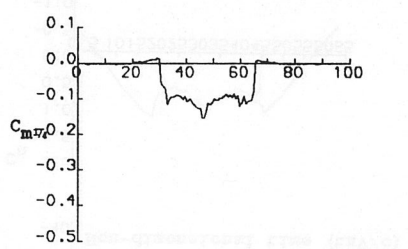


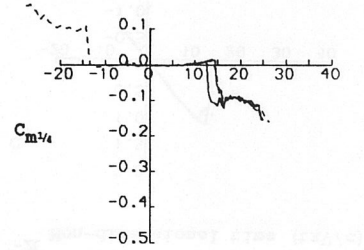


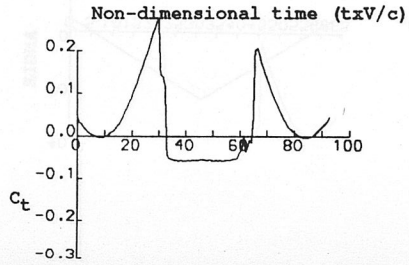


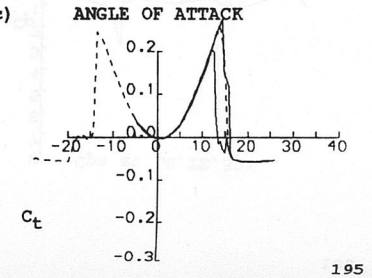








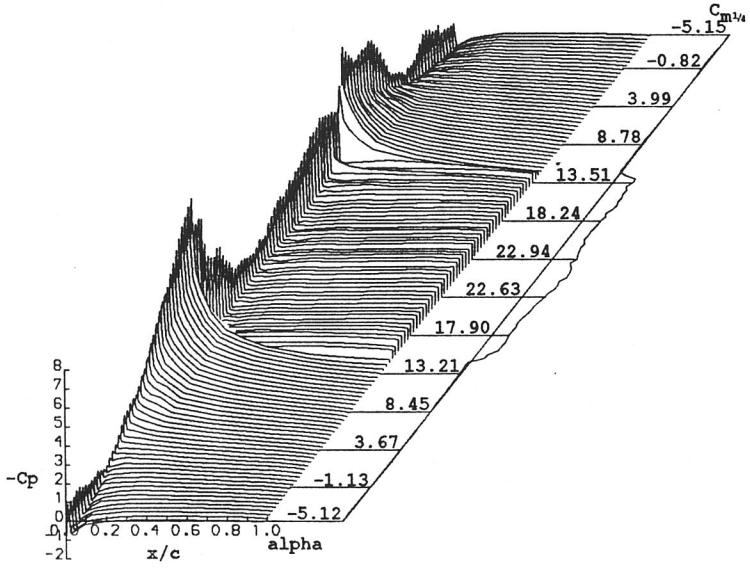


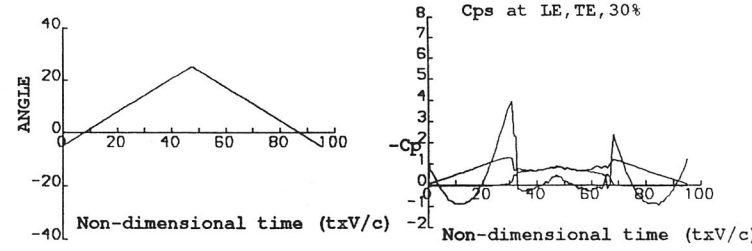


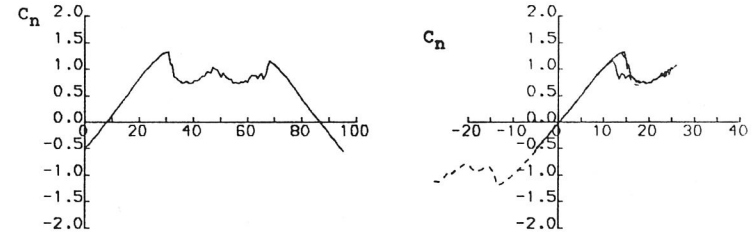
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

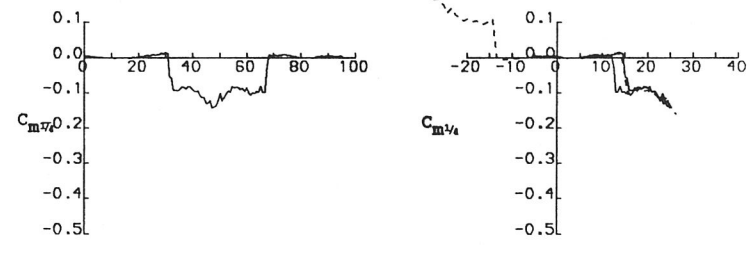
RUN REFERENCE NUMBER: 2871
REYNOLDS NUMBER = 1500464.
DYNAMIC PRESSURE = 1011.13 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

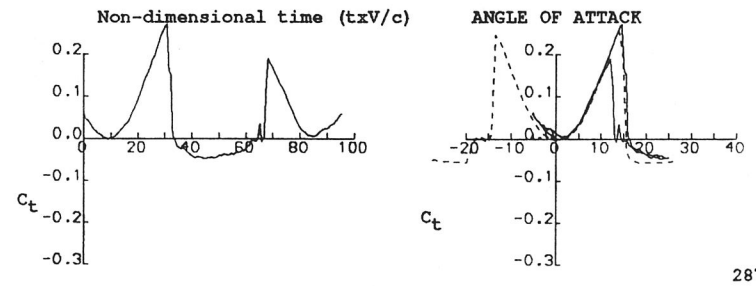
DATE OF TEST: 1/3/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 23.0°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES







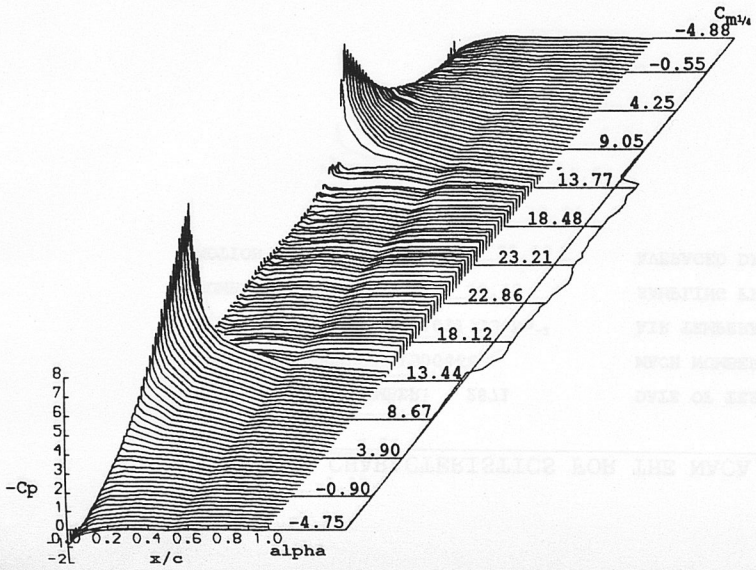


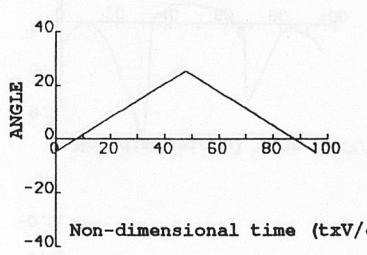


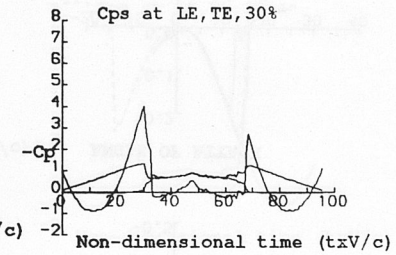
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

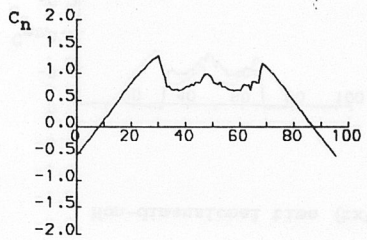
RUN REFERENCE NUMBER: 2881
REYNOLDS NUMBER = 1528066.
DYNAMIC PRESSURE = 1030.10 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

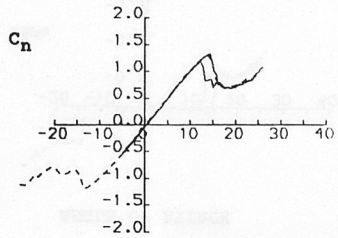
DATE OF TEST: 4/3/91
MACH NUMBER = 0.121
AIR TEMPERATURE = 21.4°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

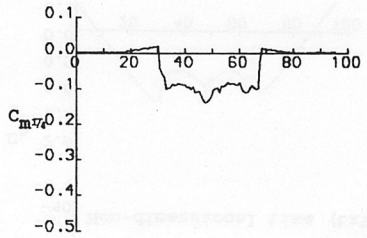


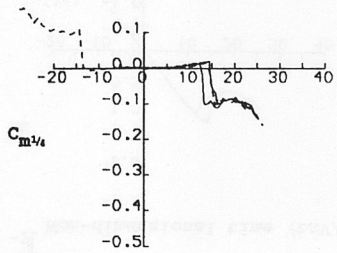


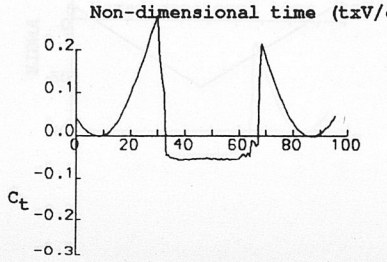


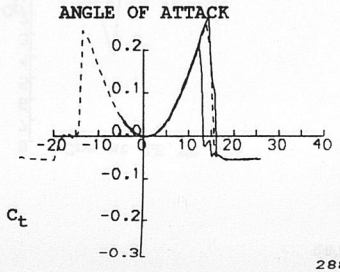








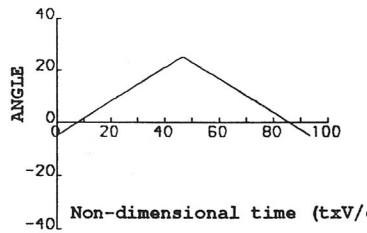


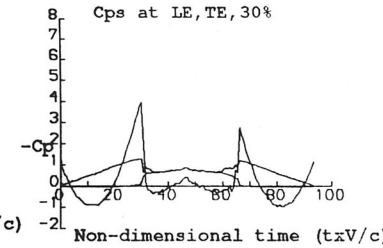


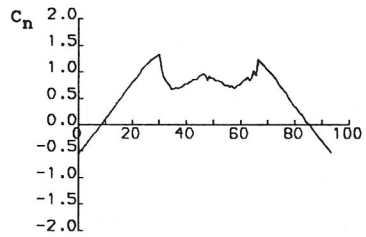
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

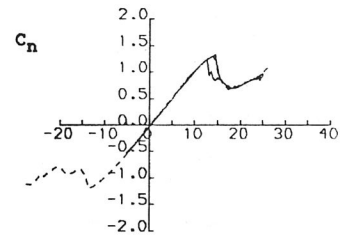
RUN REFERENCE NUMBER: 2971
REYNOLDS NUMBER = 1475813.
DYNAMIC PRESSURE = 974.22 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

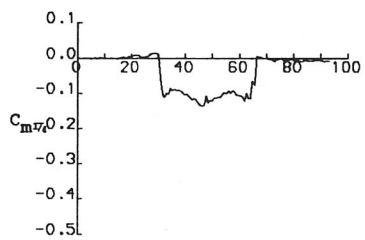
DATE OF TEST: 4/3/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 22.0°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

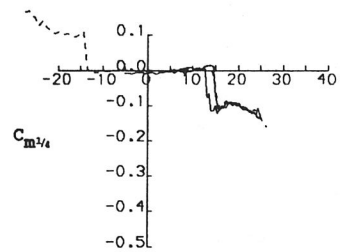


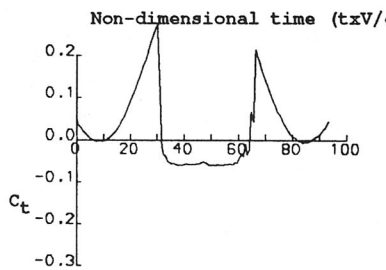


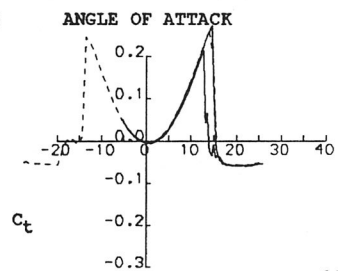


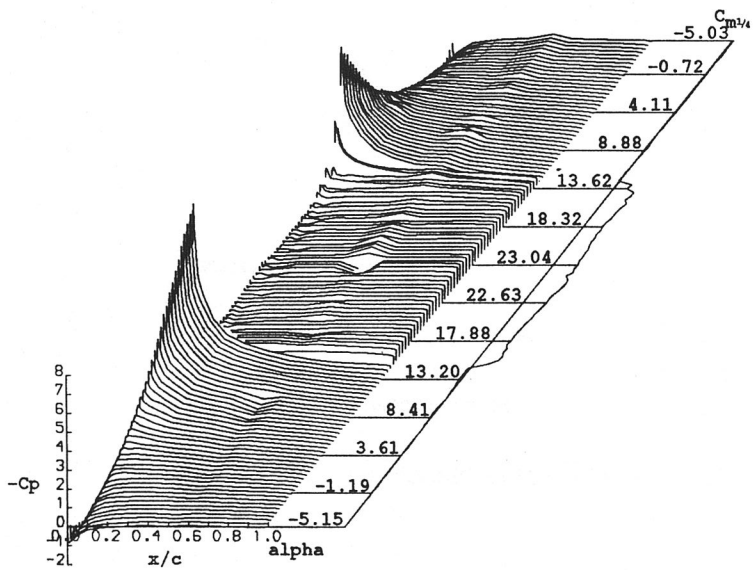








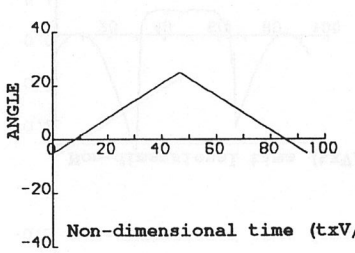


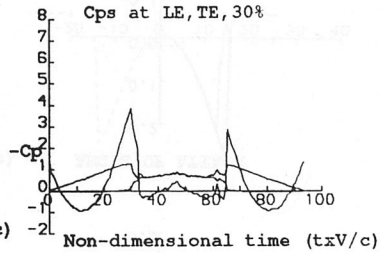


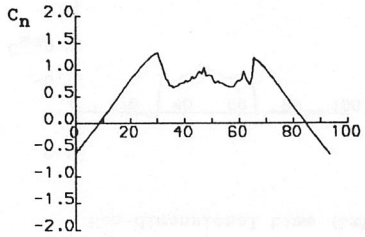
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

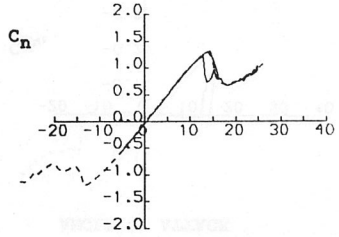
RUN REFERENCE NUMBER: 3201
REYNOLDS NUMBER = 1450403.
DYNAMIC PRESSURE = 958.71 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

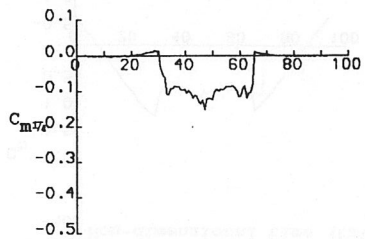
DATE OF TEST: 5/3/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 23.0°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

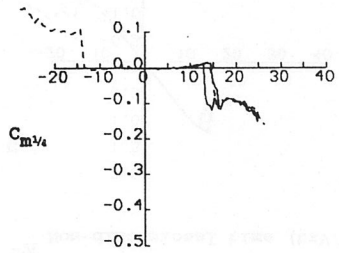


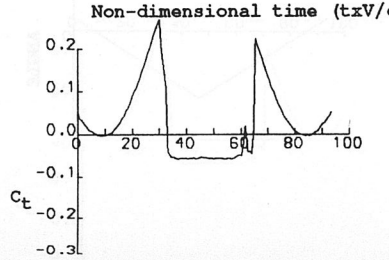


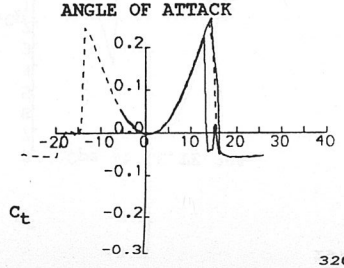


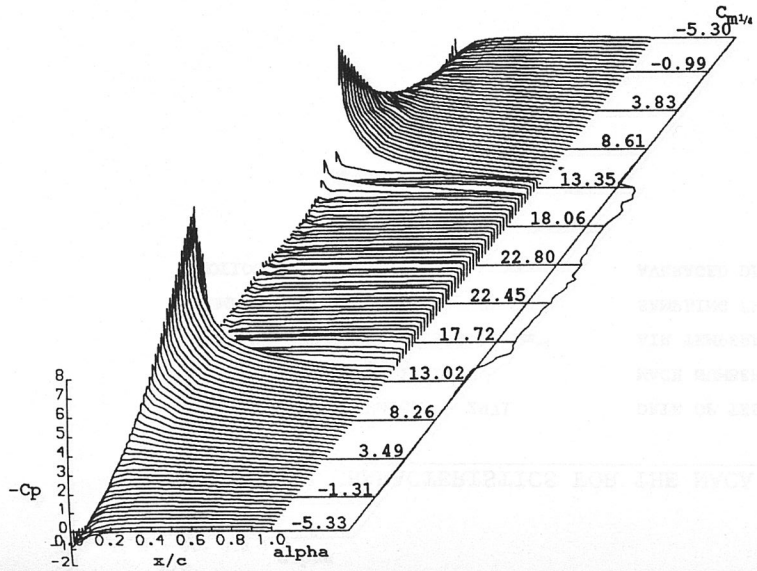












DYNAMIC CHARACTERISTICS FOR THE NACA 0012

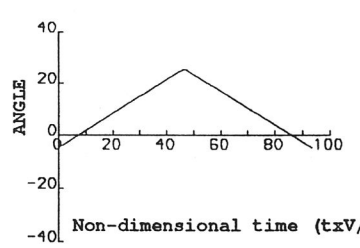
RUN REFERENCE NUMBER: 3361 DATE OF TEST: 5/3/91

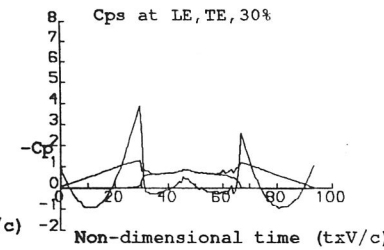
REYNOLDS NUMBER = 1460497. MACH NUMBER = 0.118

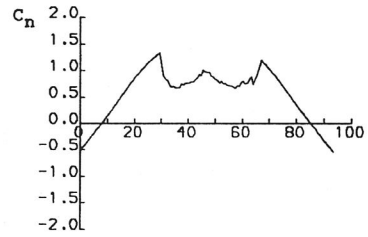
DYNAMIC PRESSURE = 963.25 Nm^{-2} AIR TEMPERATURE = 22.1°C

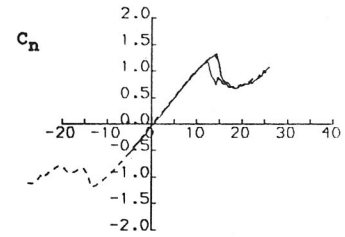
NUMBER OF CYCLES = 1 SAMPLING FREQUENCY = 100.00 Hz.

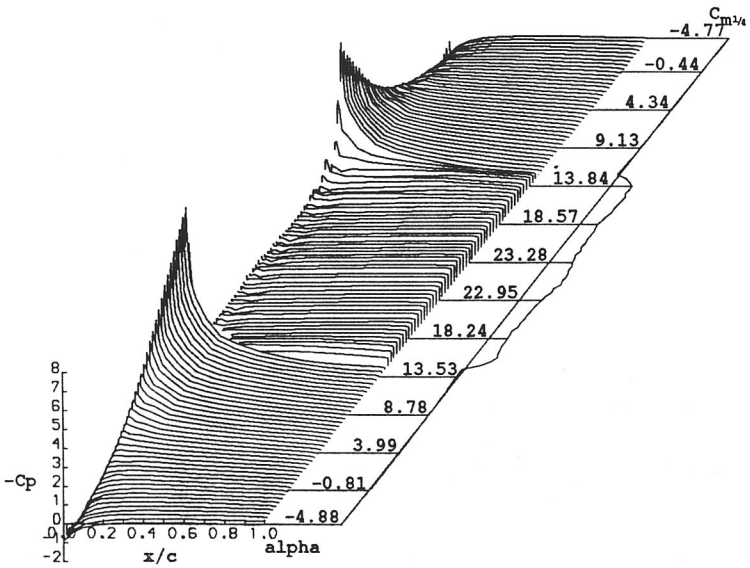
MOTION TYPE: STATIC AVERAGED DATA OF 1 CYCLES

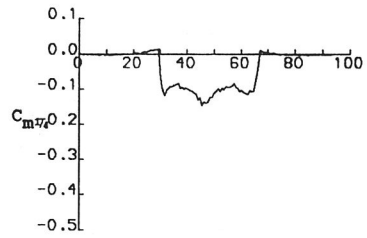


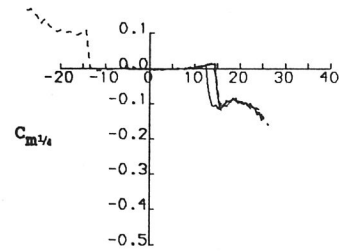


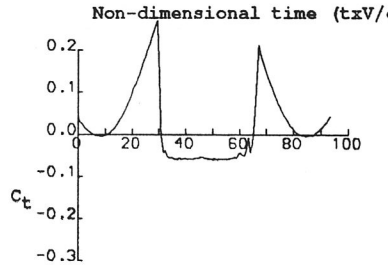


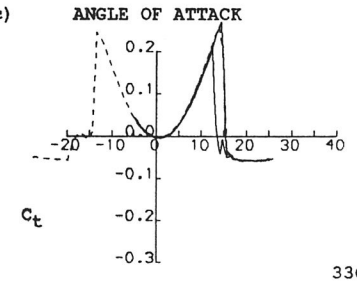








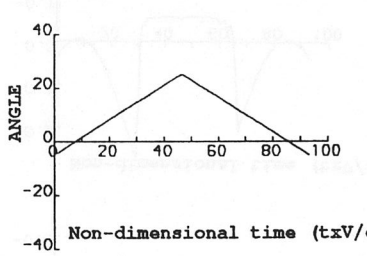


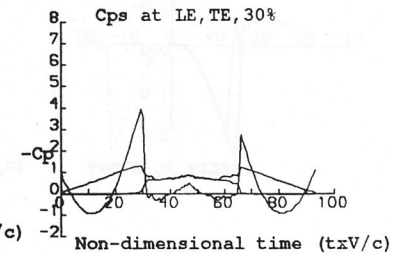


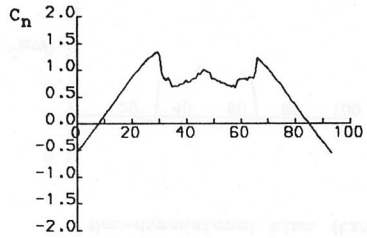
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

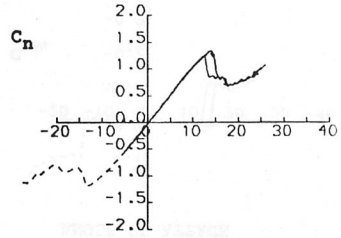
RUN REFERENCE NUMBER: 3751
REYNOLDS NUMBER = 1466646.
DYNAMIC PRESSURE = 964.18 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

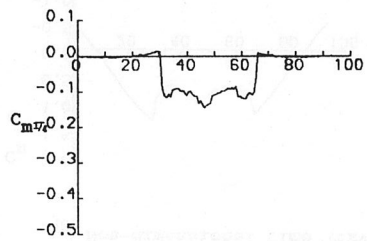
DATE OF TEST: 5/3/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 21.4°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

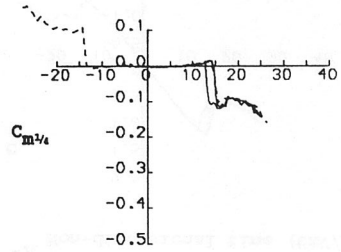


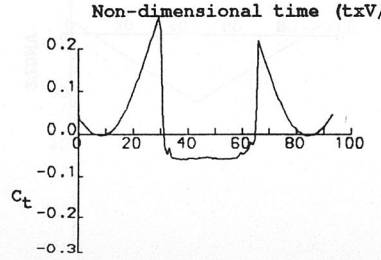


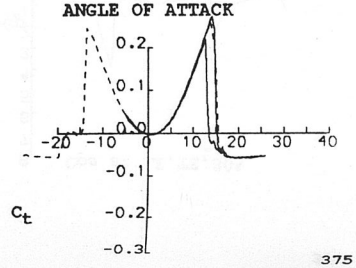


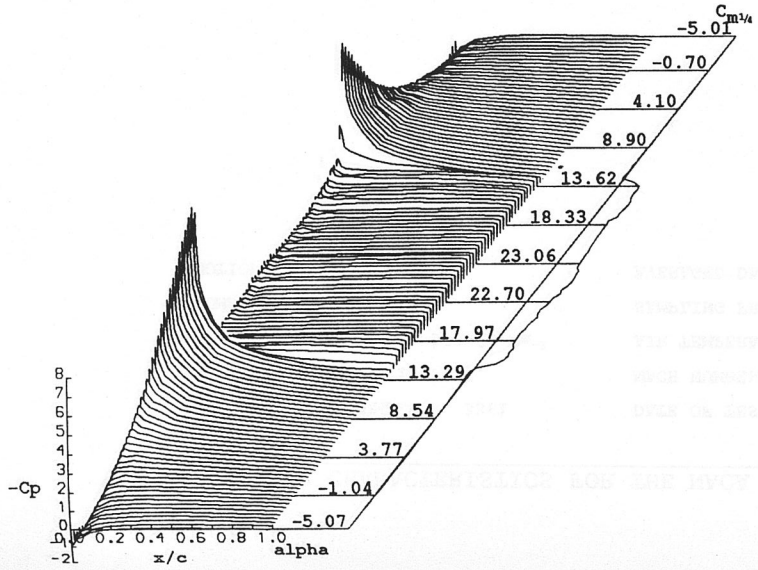








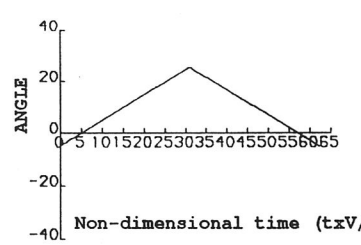


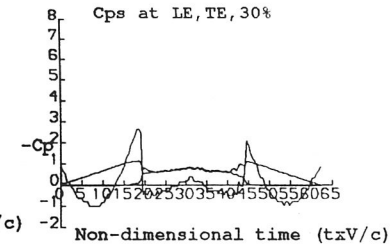


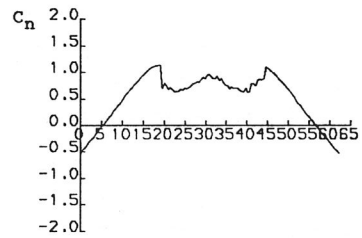
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

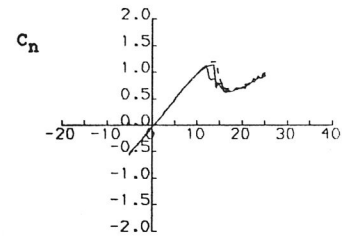
RUN REFERENCE NUMBER: 4131
REYNOLDS NUMBER = 979955.
DYNAMIC PRESSURE = 429.70 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

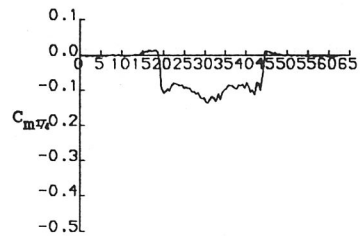
DATE OF TEST: 6/3/91
MACH NUMBER = 0.078
AIR TEMPERATURE = 21.2°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

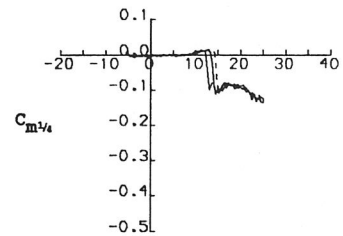


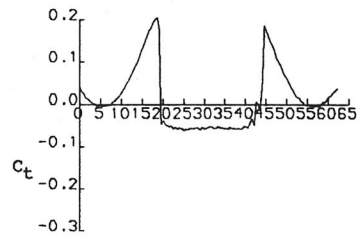


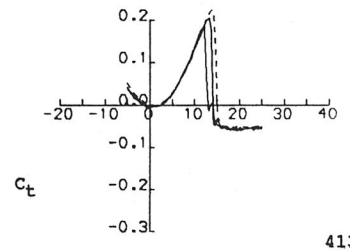


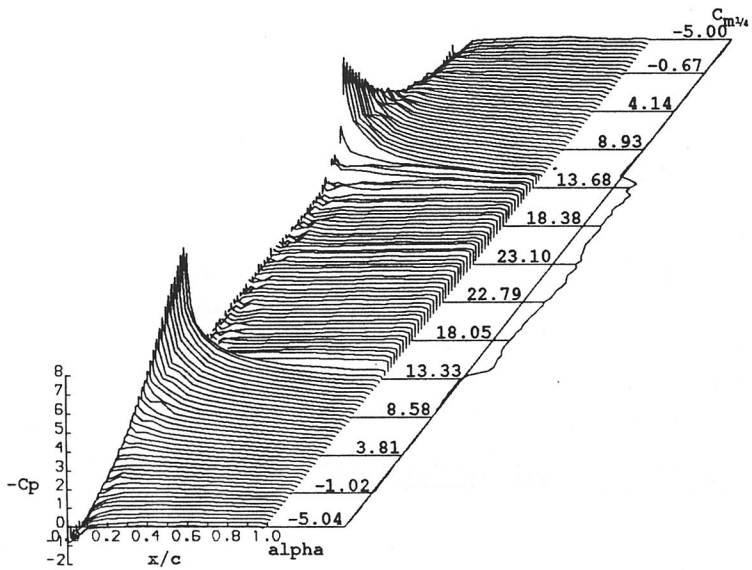








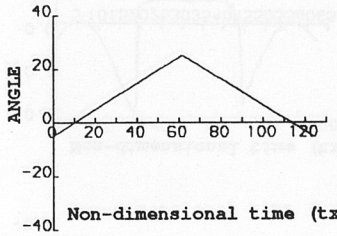


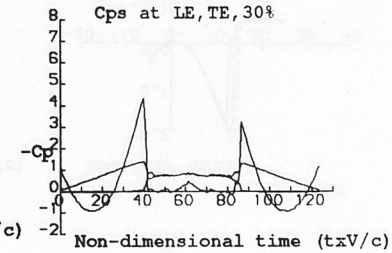


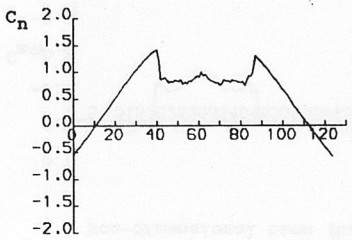
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

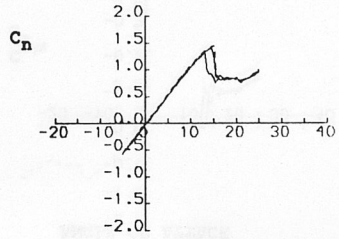
RUN REFERENCE NUMBER: 4301
REYNOLDS NUMBER = 1892112.
DYNAMIC PRESSURE = 1669.81 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

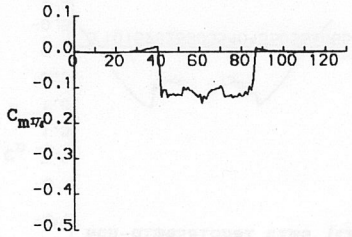
DATE OF TEST: 6/3/91
MACH NUMBER = 0.155
AIR TEMPERATURE = 26.0°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

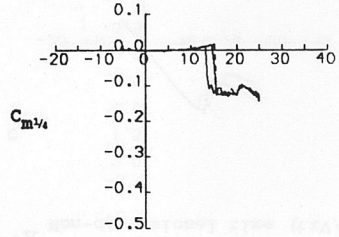


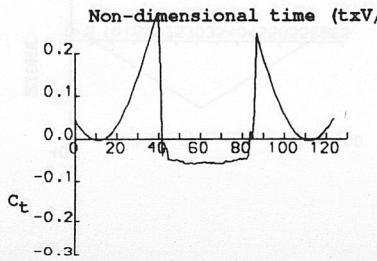


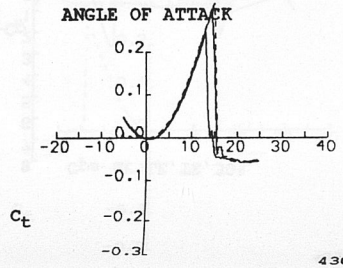


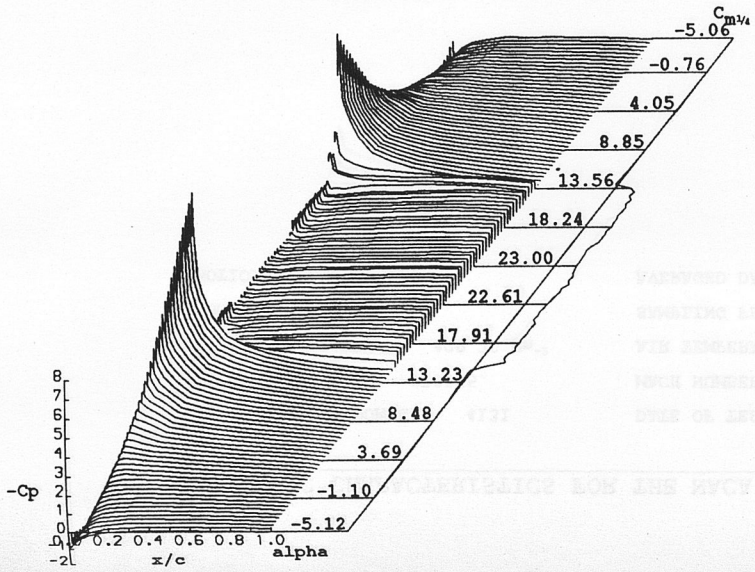








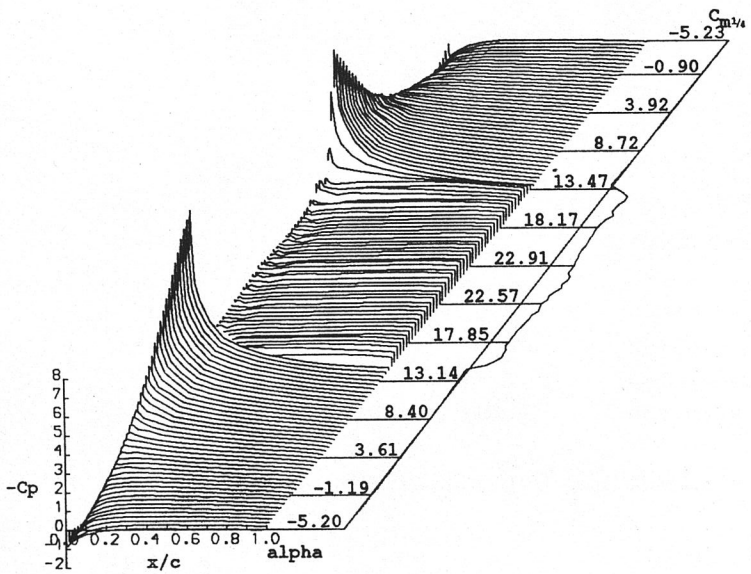


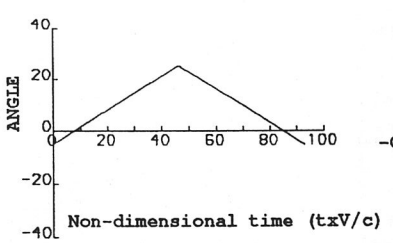


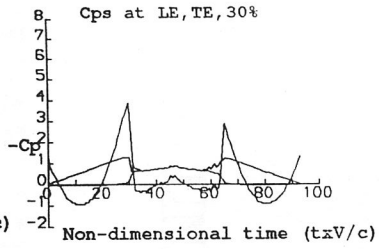
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

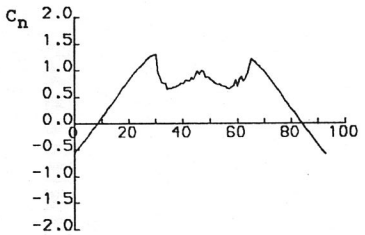
RUN REFERENCE NUMBER: 4471
REYNOLDS NUMBER = 1428779.
DYNAMIC PRESSURE = 940.15 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

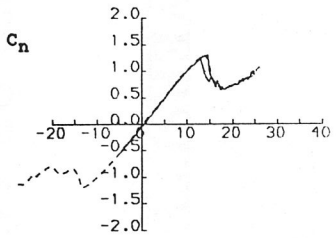
DATE OF TEST: 7/3/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 23.2°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES

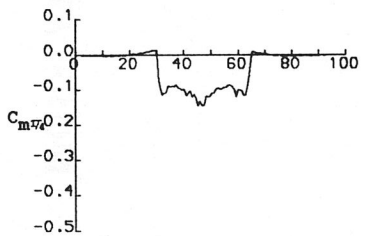


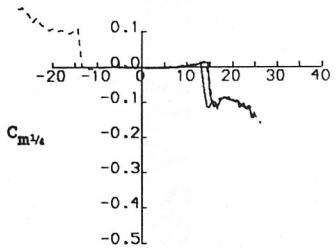


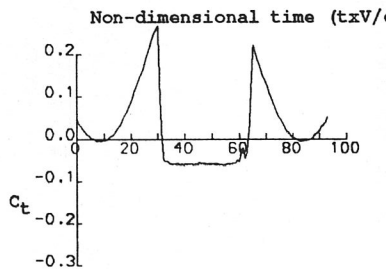


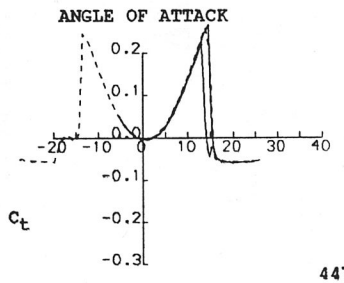












G.U. Aero Report 9207

UNIVERSITY OF GLASGOW

DEPARTMENT OF AEROSPACE ENGINEERING

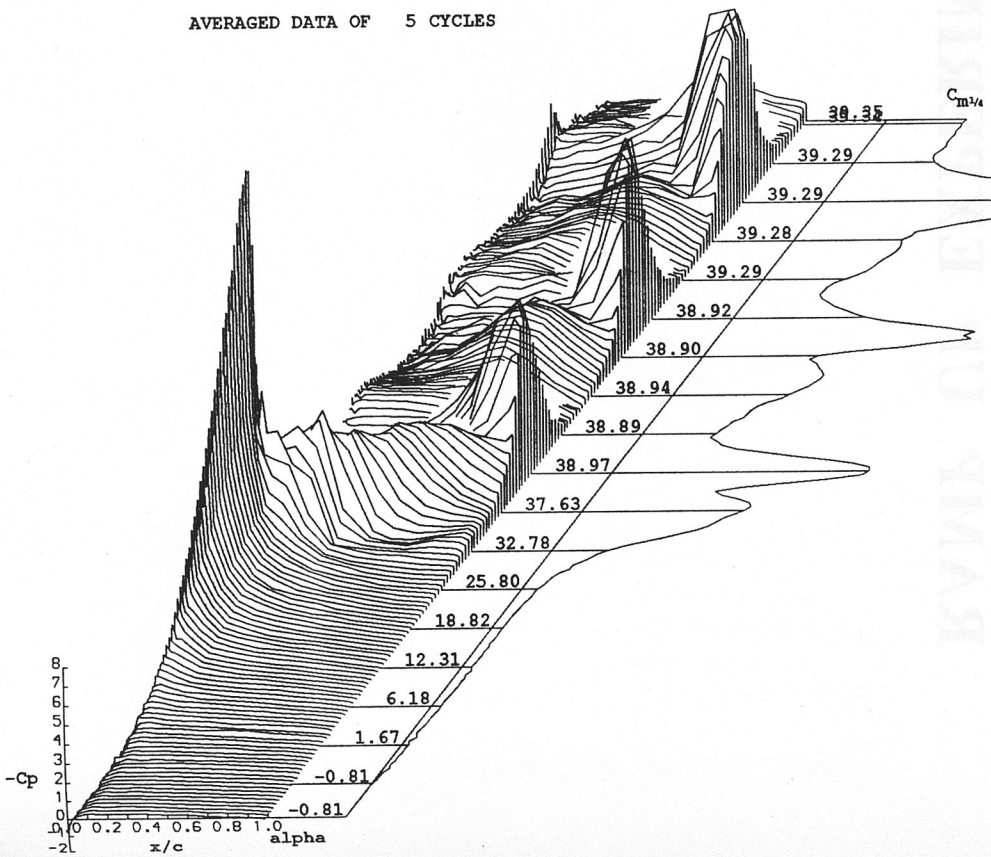
PRESSURE DATA FROM

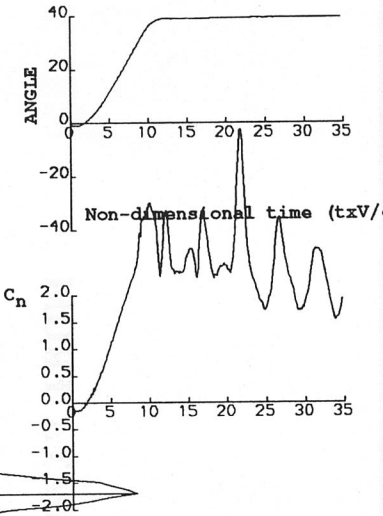
RAMP UP EXPERIMENTS

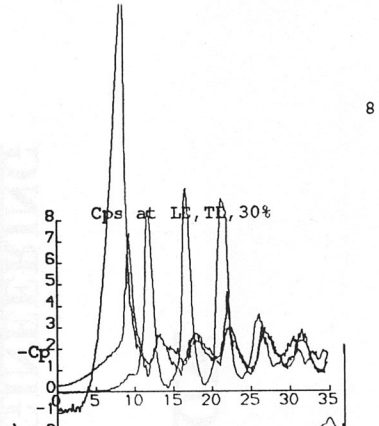
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

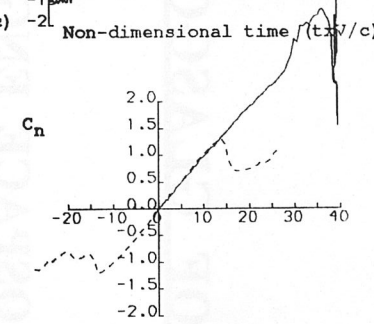
RUN REFERENCE NUMBER: 20082
REYNOLDS NUMBER = 1502789.
DYNAMIC PRESSURE = 1011.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

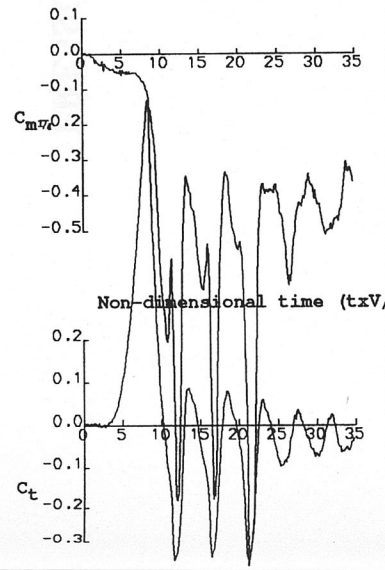
DATE OF TEST: 17/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 22.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.04149
LINEAR PITCH RATE = 356.95°S^{-1}

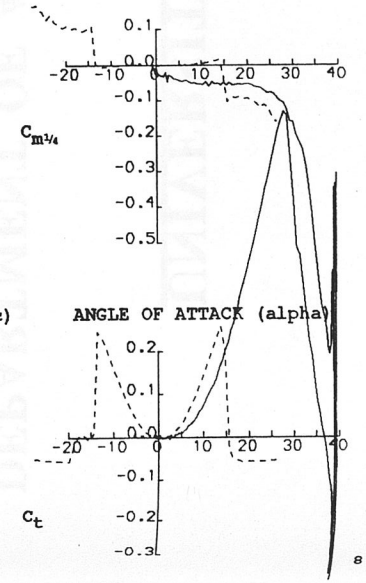








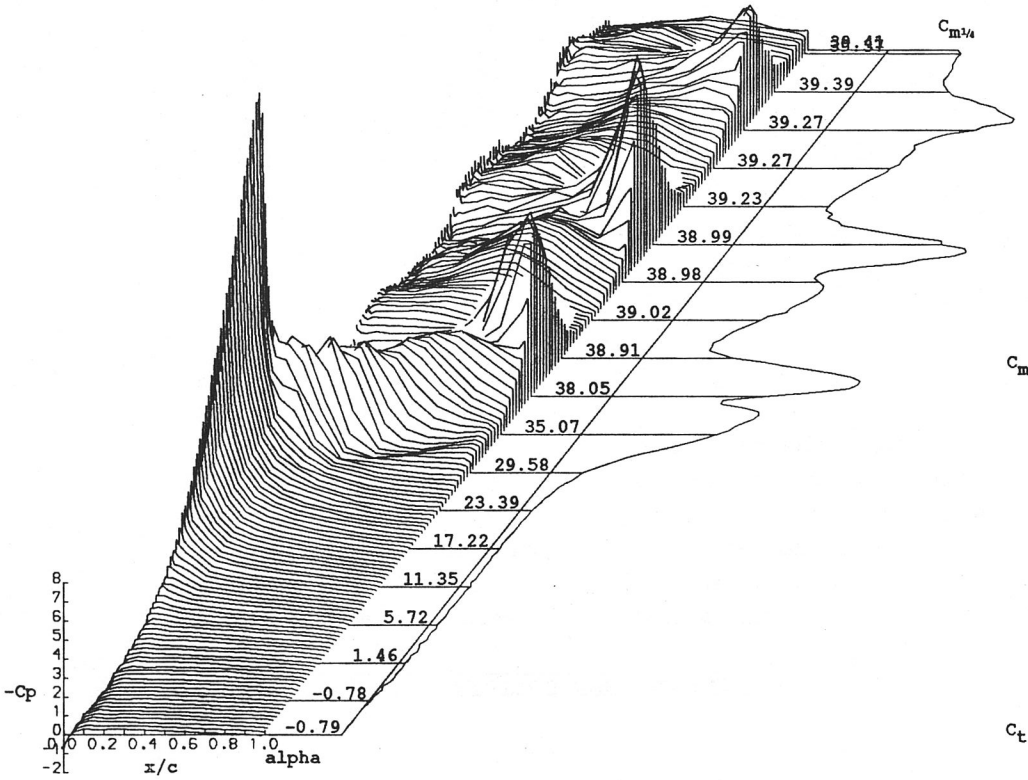


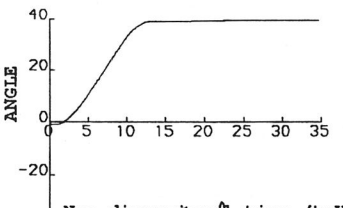


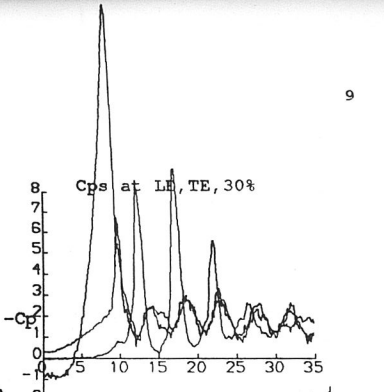
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

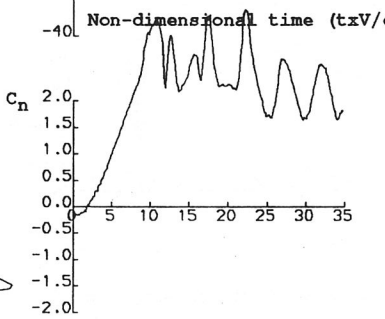
RUN REFERENCE NUMBER: 20092
REYNOLDS NUMBER = 1494990.
DYNAMIC PRESSURE = 1011.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

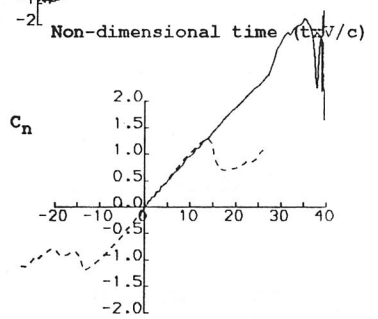
DATE OF TEST: 17/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 23.4°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03804
LINEAR PITCH RATE = $327.98°S^{-1}$

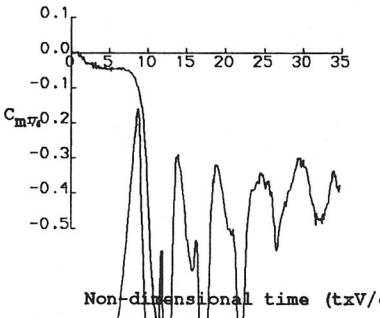


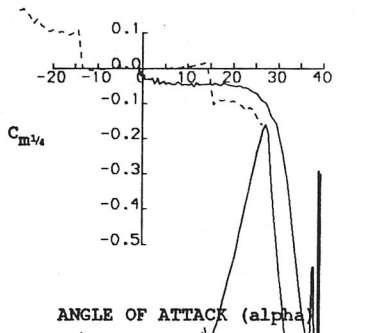


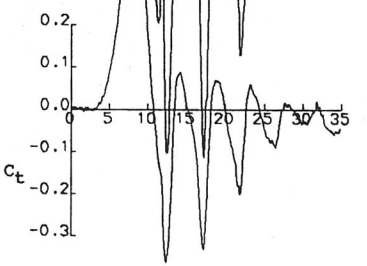


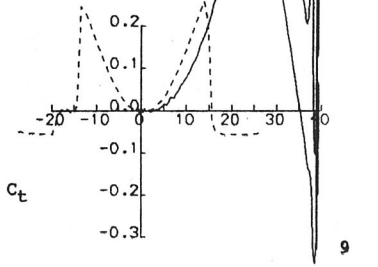








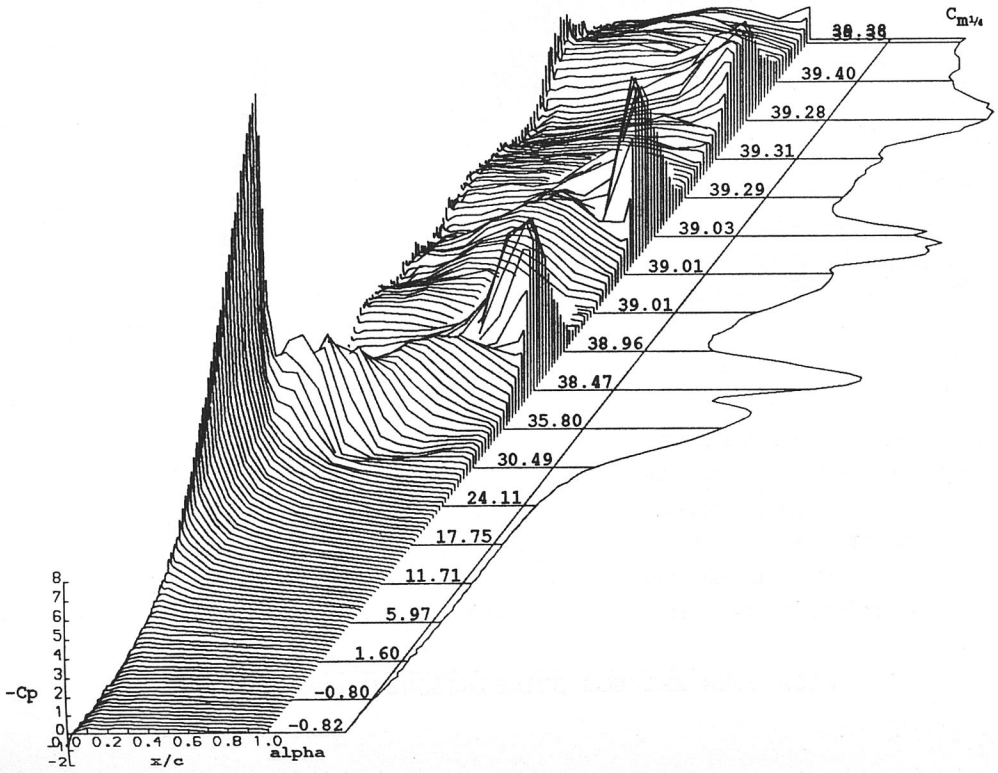


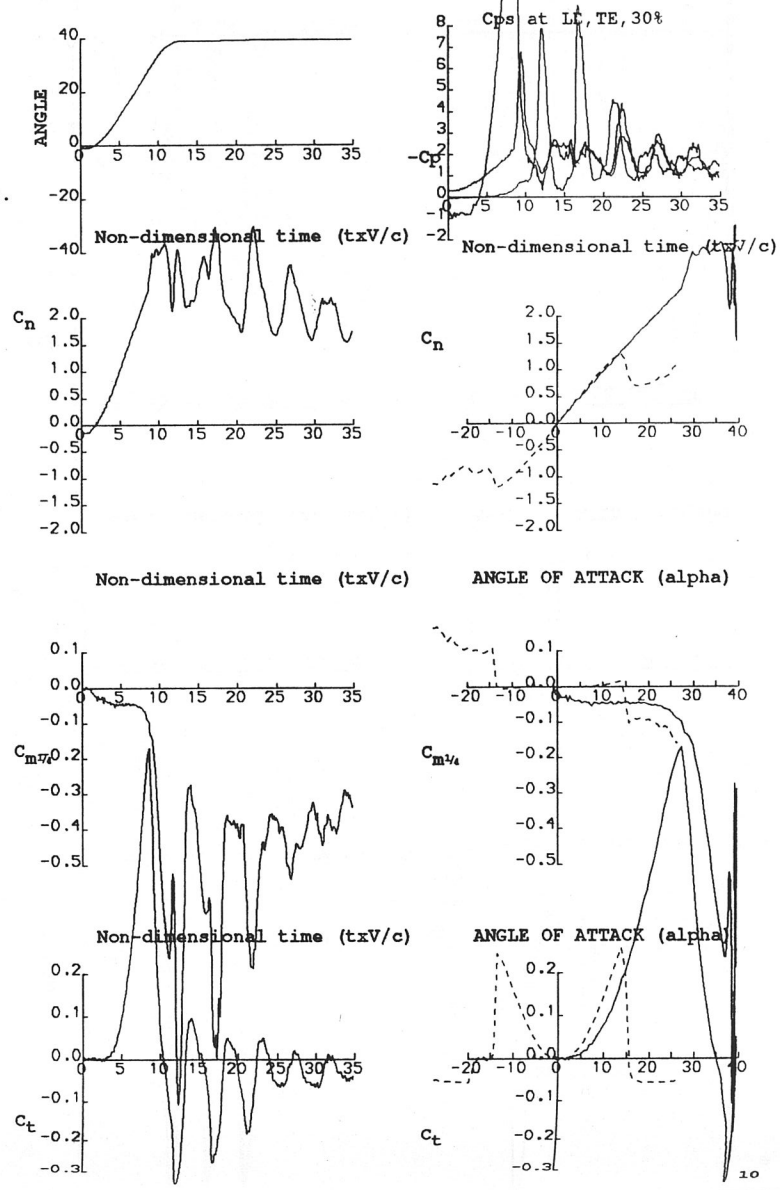


DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 20102
REYNOLDS NUMBER = 1491763.
DYNAMIC PRESSURE = 1011.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 17/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 23.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03938
LINEAR PITCH RATE = 339.76°S^{-1}

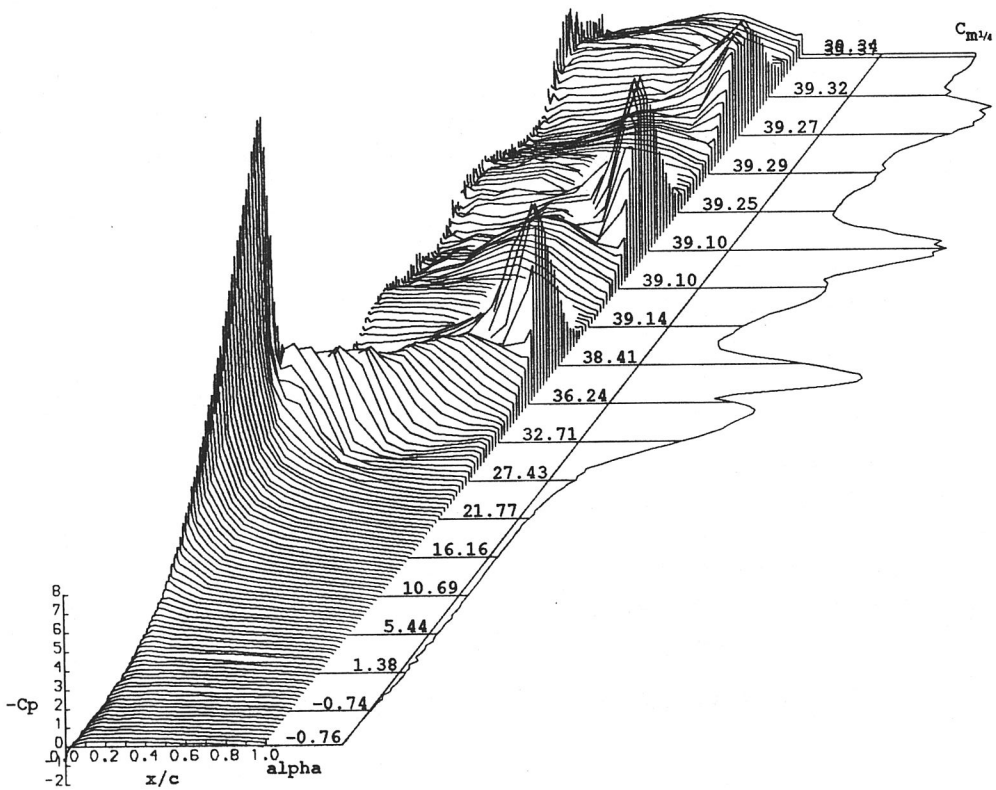


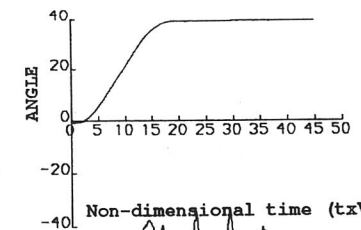


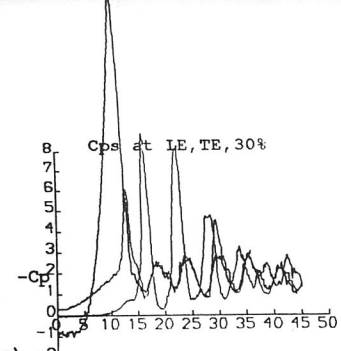
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 20112
REYNOLDS NUMBER = 789772.
DYNAMIC PRESSURE = 1011.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

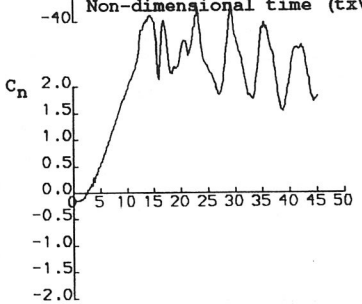
DATE OF TEST: 17/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = ****°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02697
LINEAR PITCH RATE = 301.08°S^{-1}



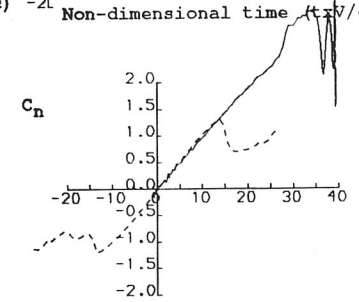




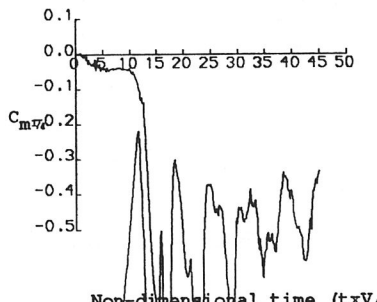
Non-dimensional time (txV/c)



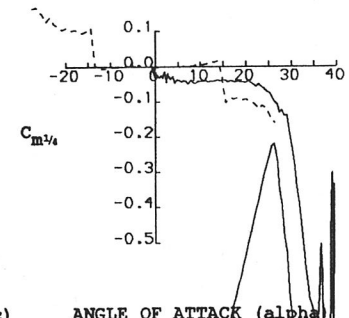
Non-dimensional time (txV/c)



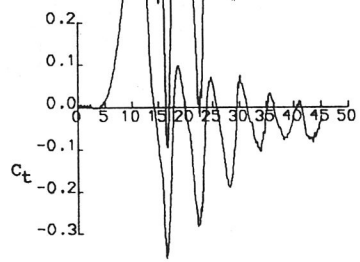
ANGLE OF ATTACK (alpha)

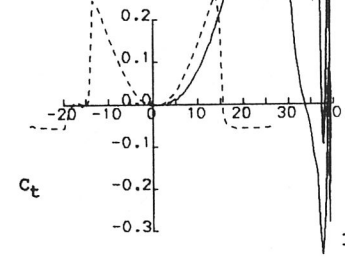


Non-dimensional time (txV/c)



ANGLE OF ATTACK (alpha)

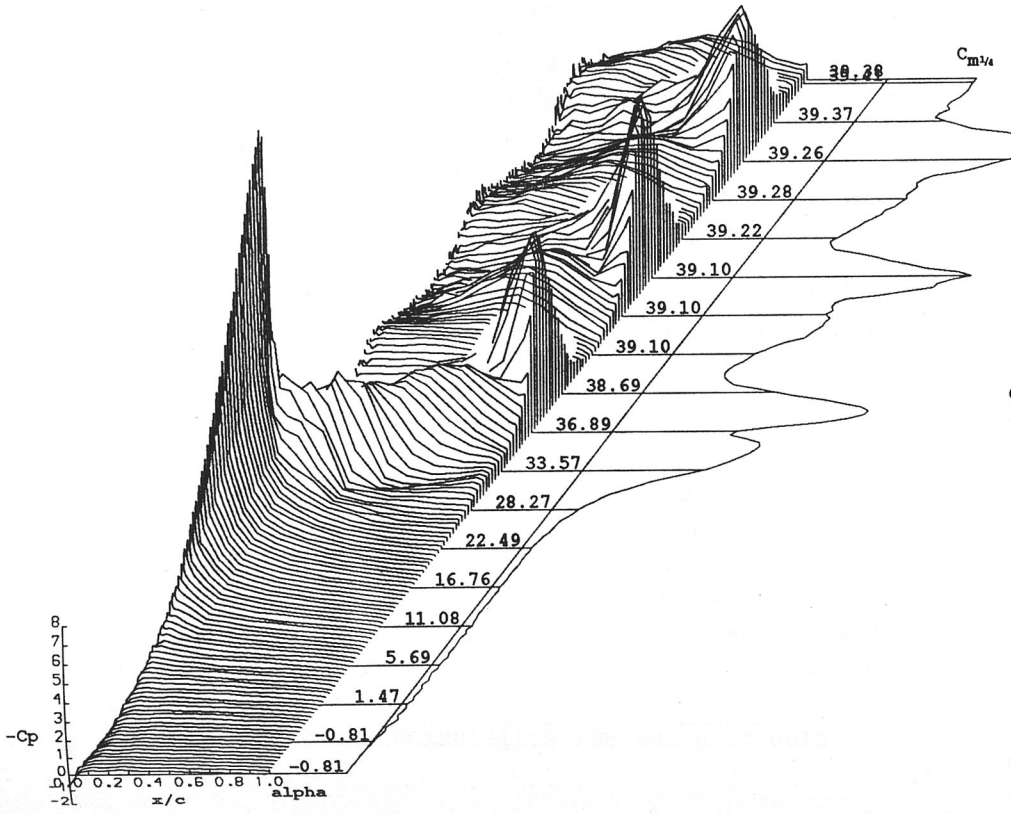


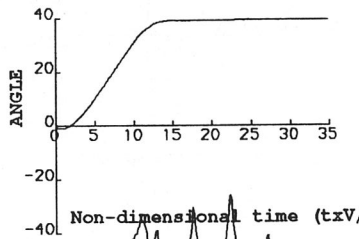


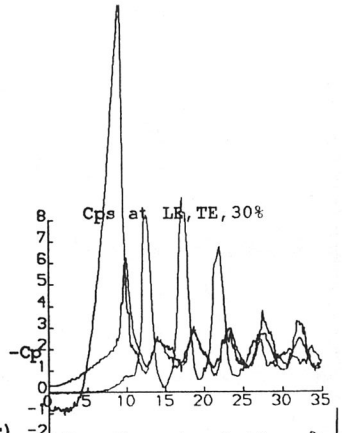
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

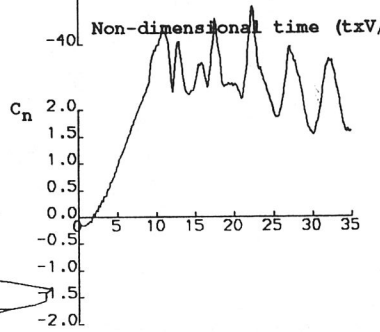
RUN REFERENCE NUMBER: 20122
REYNOLDS NUMBER = 1487908.
DYNAMIC PRESSURE = 1011.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

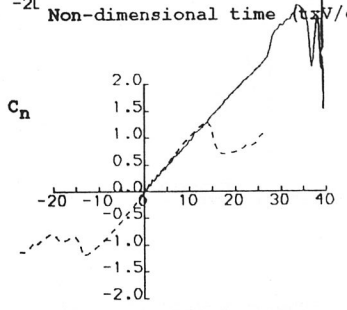
DATE OF TEST: 17/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 24.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03603
LINEAR PITCH RATE = 311.22°S^{-1}

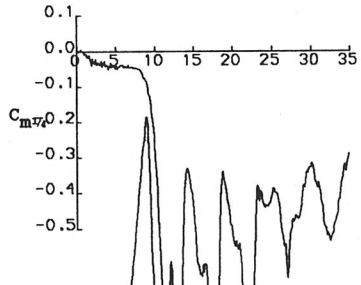


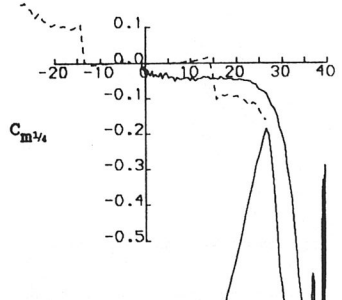


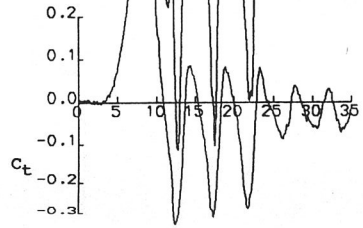


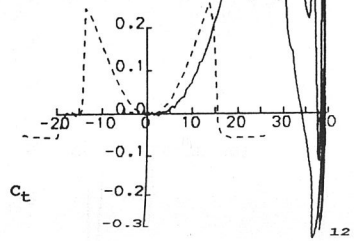








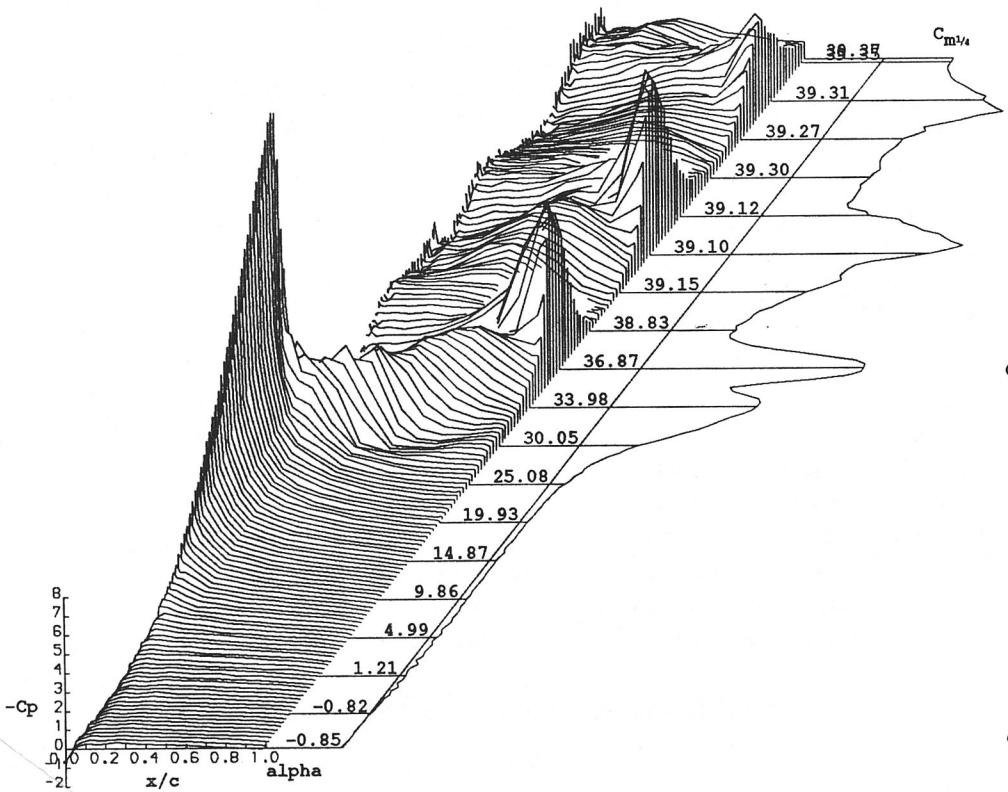


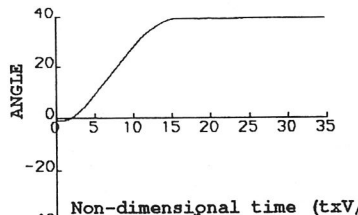


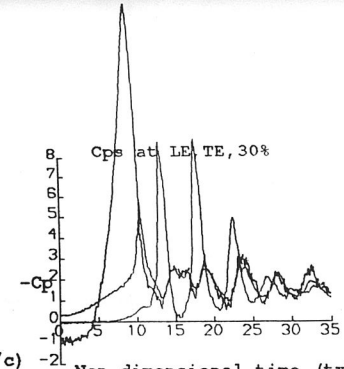
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

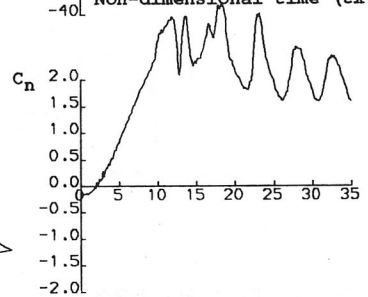
RUN REFERENCE NUMBER: 20132
REYNOLDS NUMBER = 1484071.
DYNAMIC PRESSURE = 1011.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

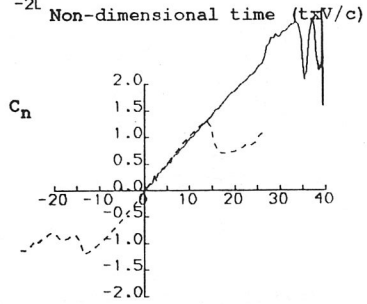
DATE OF TEST: 17/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 25.1°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03193
LINEAR PITCH RATE = 276.05°S^{-1}

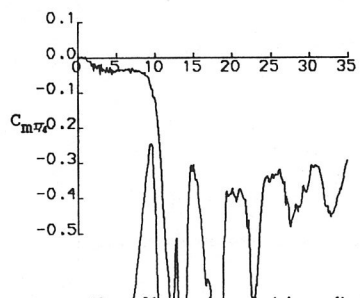


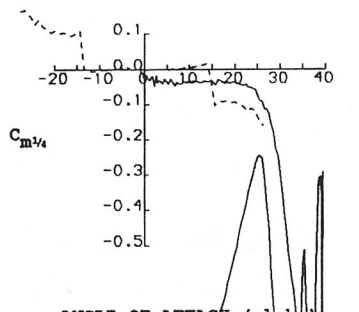


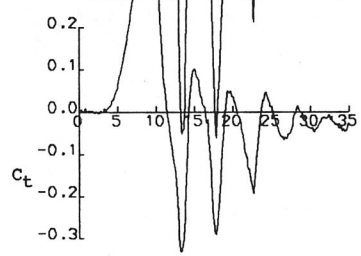


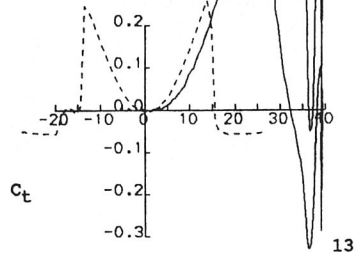








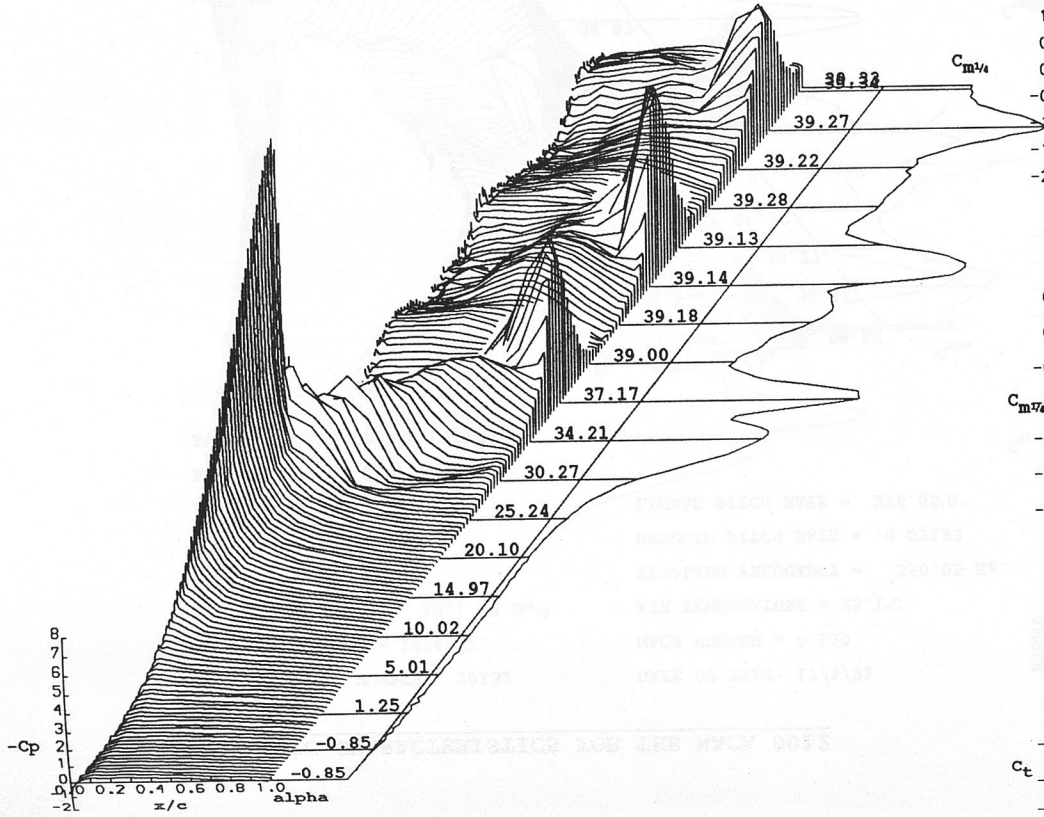


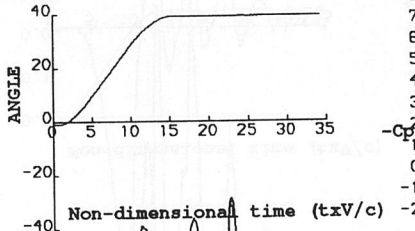


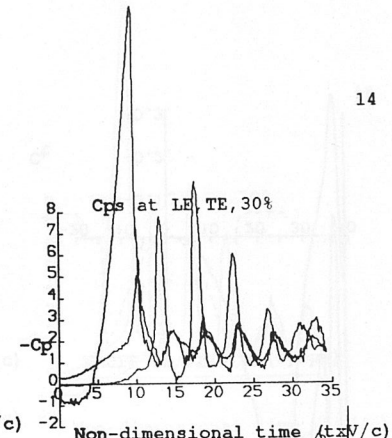
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

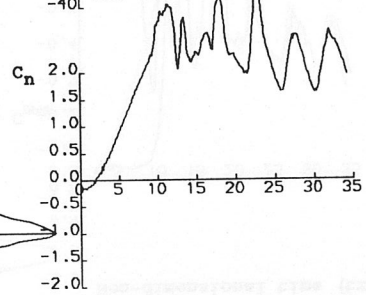
RUN REFERENCE NUMBER: 20142
REYNOLDS NUMBER = 1465135.
DYNAMIC PRESSURE = 975.34 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

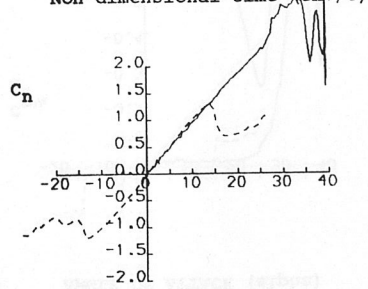
DATE OF TEST: 17/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03286
LINEAR PITCH RATE = 278.45°S^{-1}

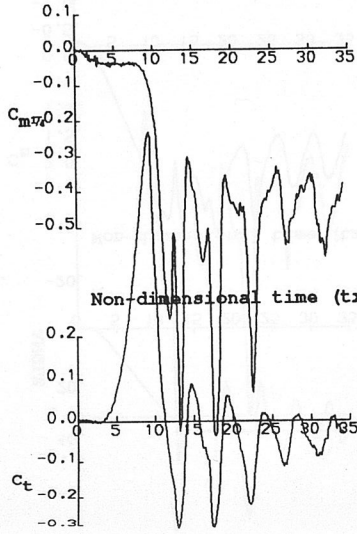


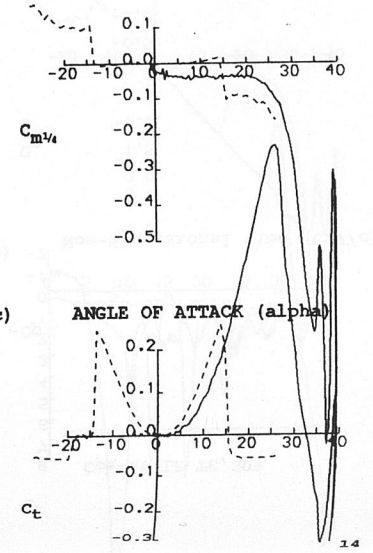








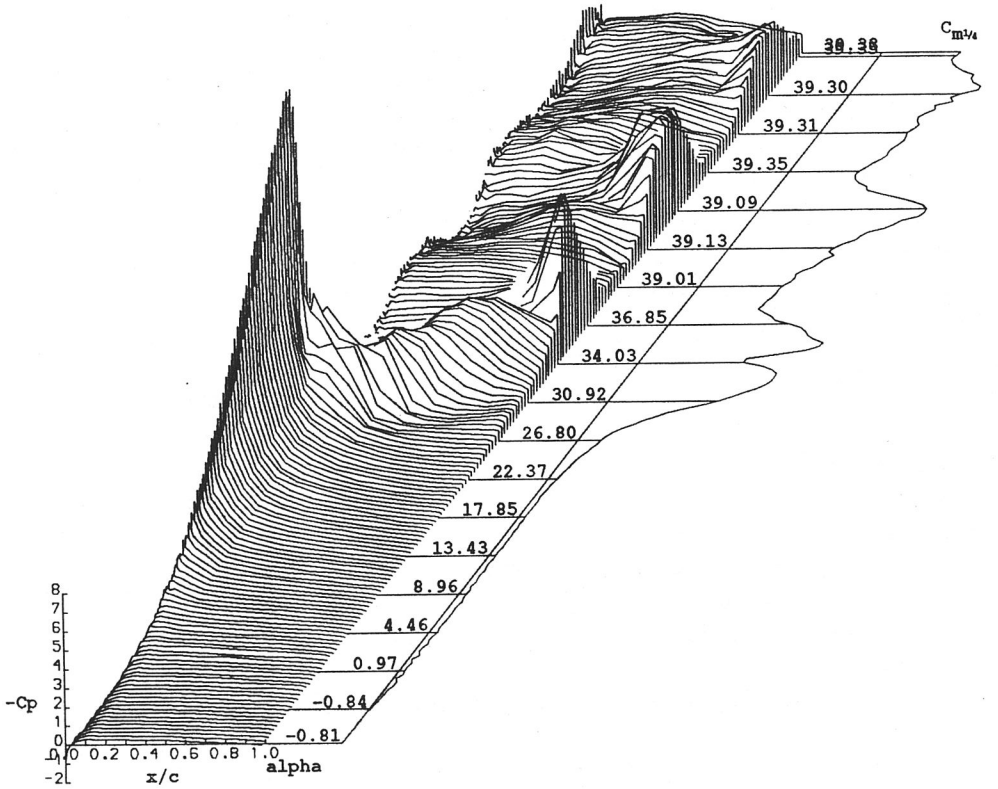


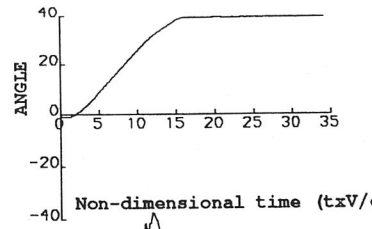


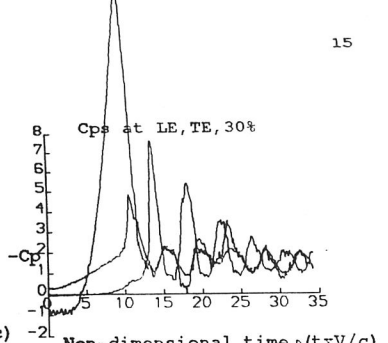
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

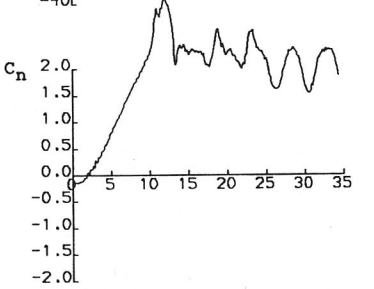
RUN REFERENCE NUMBER: 20152
REYNOLDS NUMBER = 1459462.
DYNAMIC PRESSURE = 975.34 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

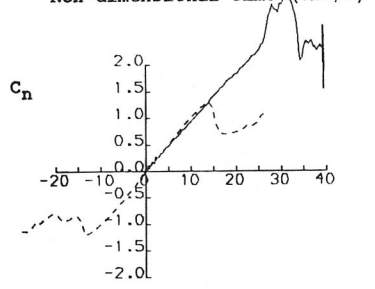
DATE OF TEST: 17/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02879
LINEAR PITCH RATE = 244.31°S^{-1}

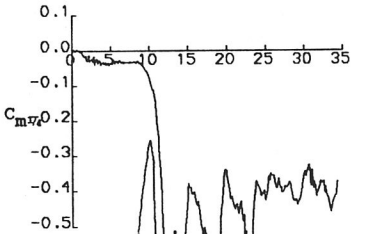


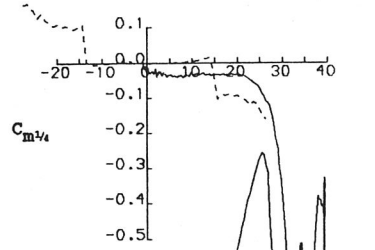


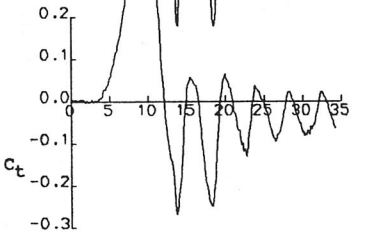


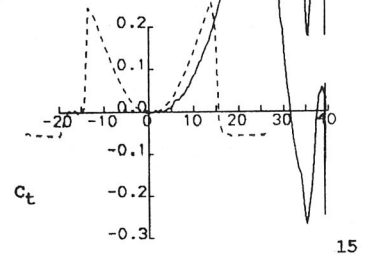








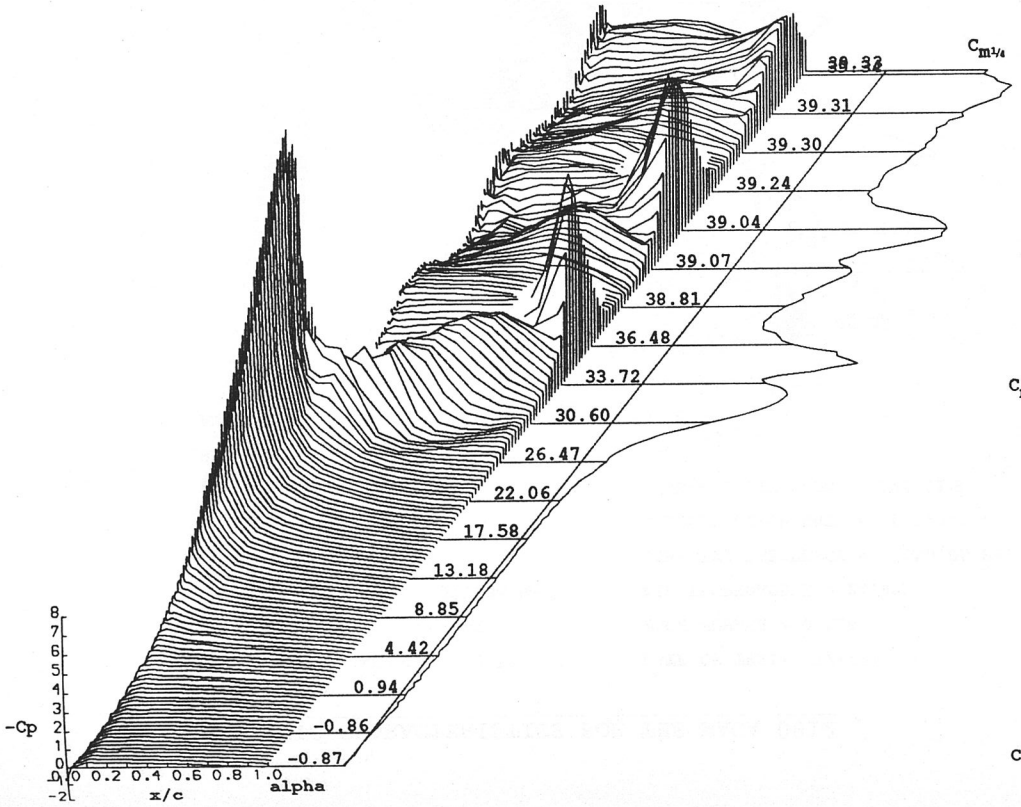


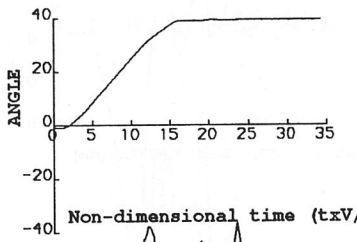


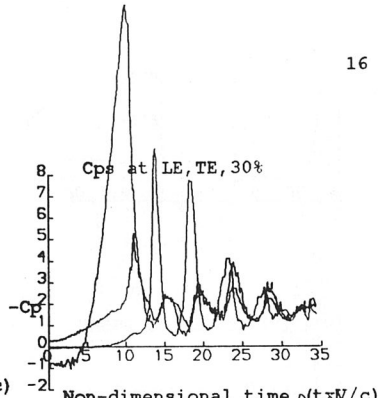
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

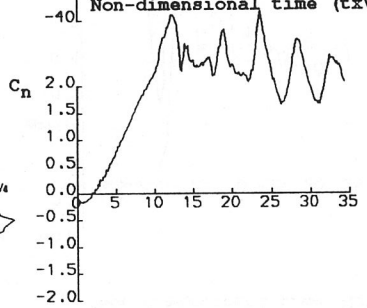
RUN REFERENCE NUMBER: 20162
REYNOLDS NUMBER = 1456954.
DYNAMIC PRESSURE = 975.34 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

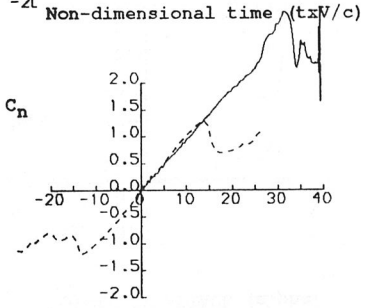
DATE OF TEST: 17/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02842
LINEAR PITCH RATE = 241.39°S^{-1}

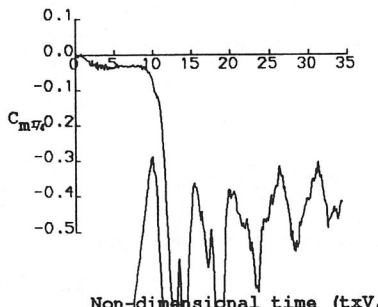


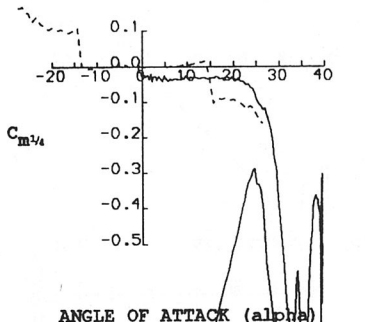


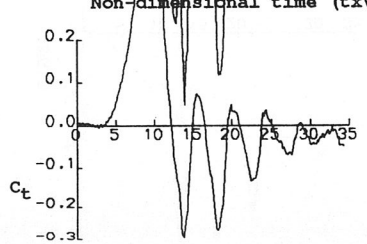


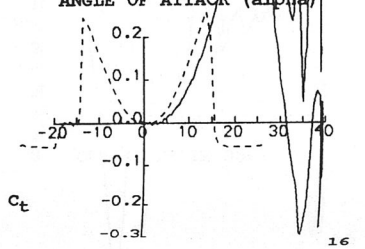








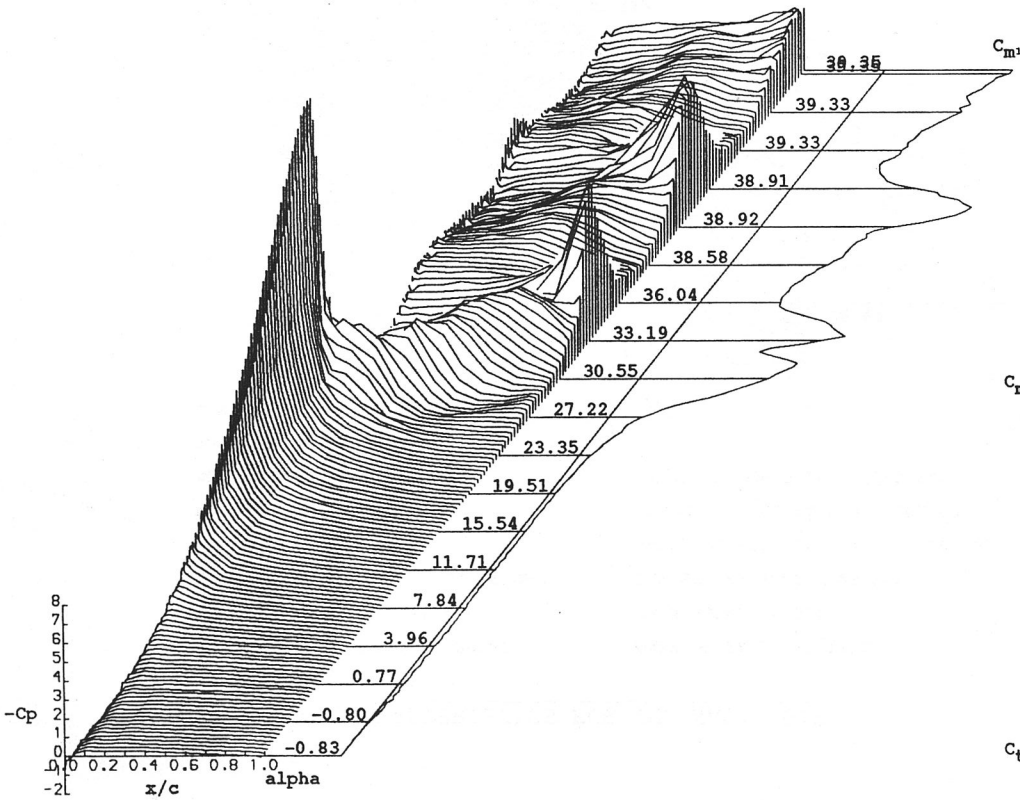


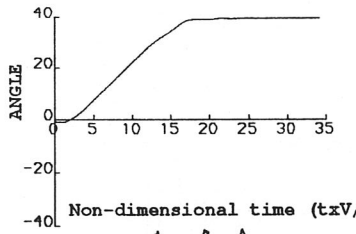


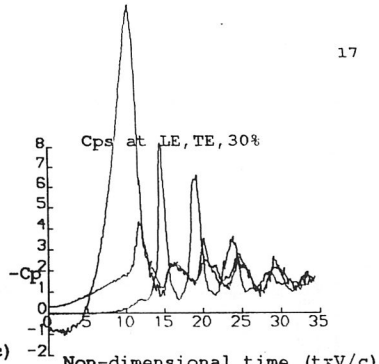
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

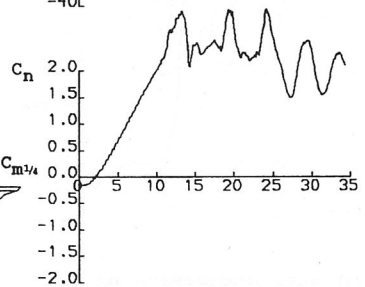
RUN REFERENCE NUMBER: 20172
REYNOLDS NUMBER = 1453208.
DYNAMIC PRESSURE = 975.34 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

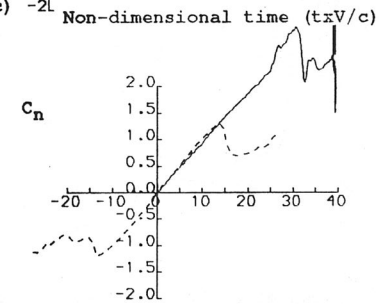
DATE OF TEST: 17/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02494
LINEAR PITCH RATE = 212.07°S^{-1}

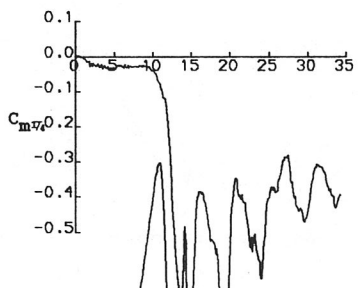


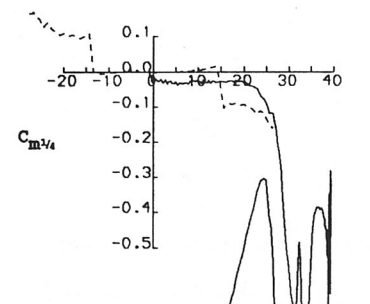


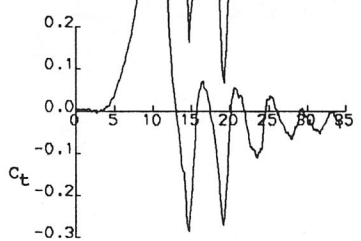


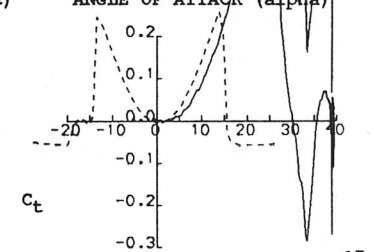








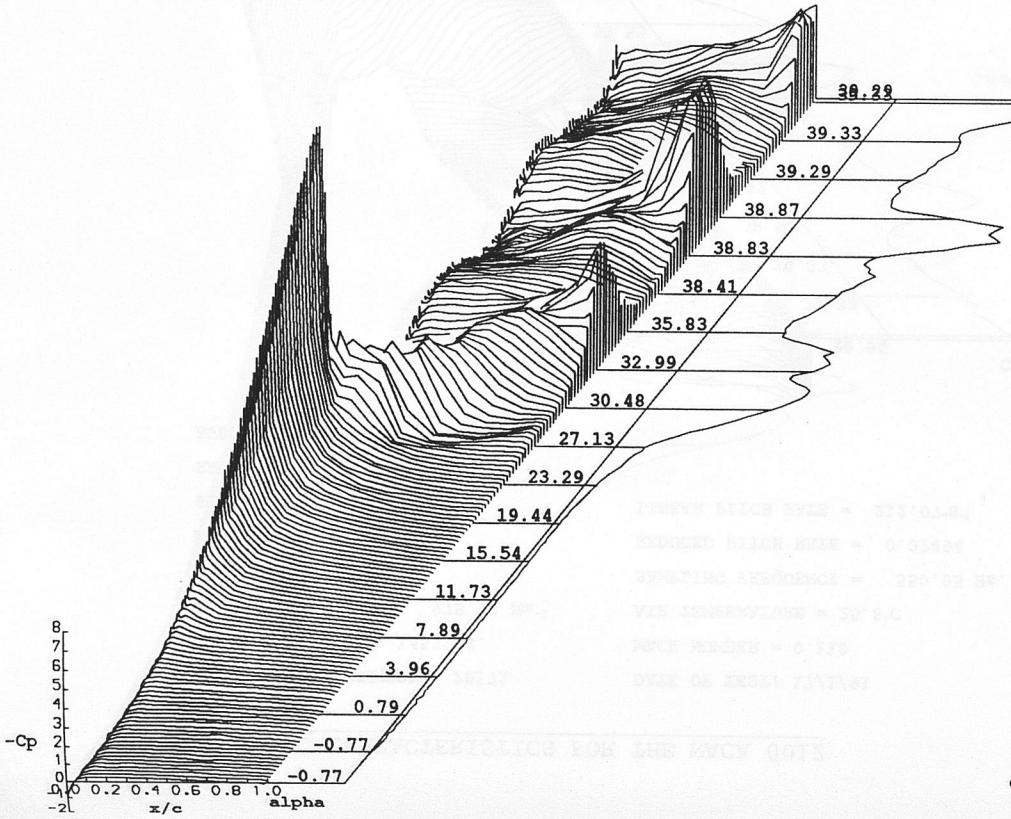


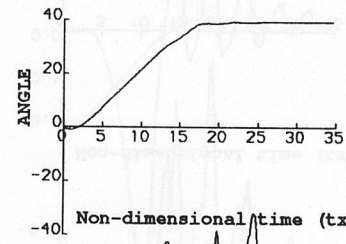


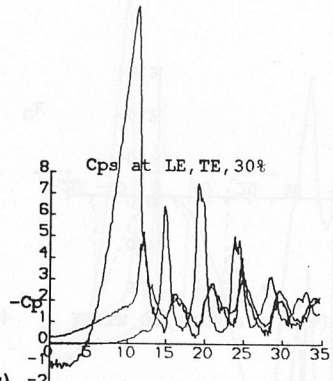
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

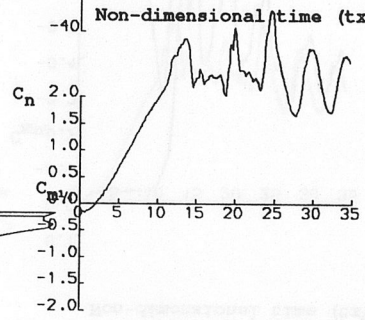
RUN REFERENCE NUMBER: 20182
REYNOLDS NUMBER = 1486285.
DYNAMIC PRESSURE = 1001.97 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

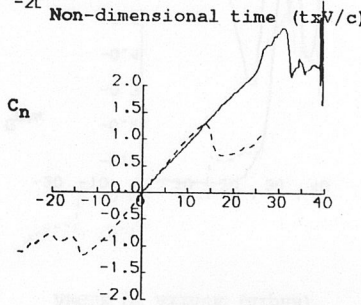
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 23.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02452
LINEAR PITCH RATE = 210.54°S^{-1}

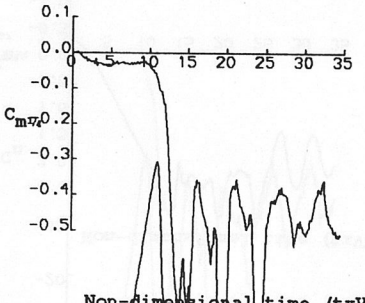


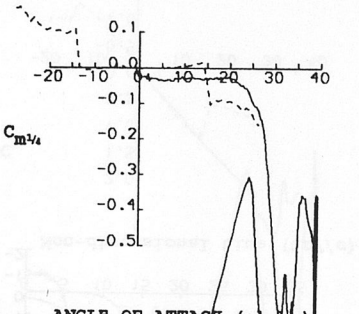


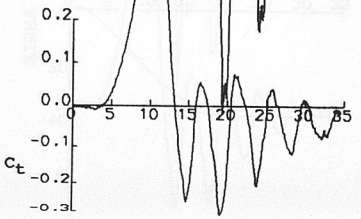


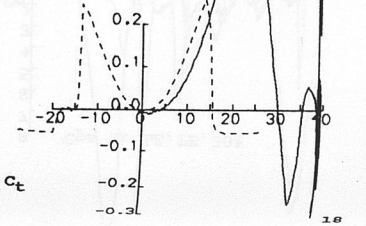








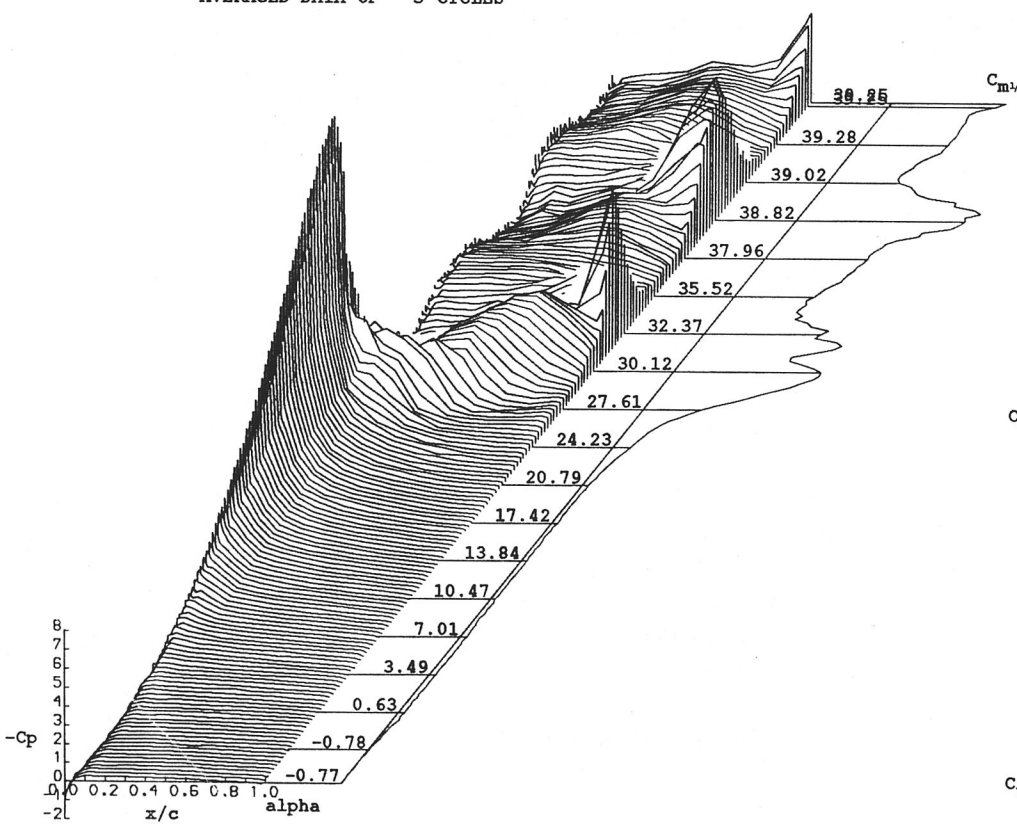


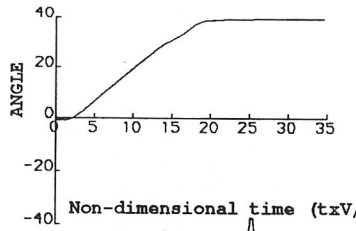


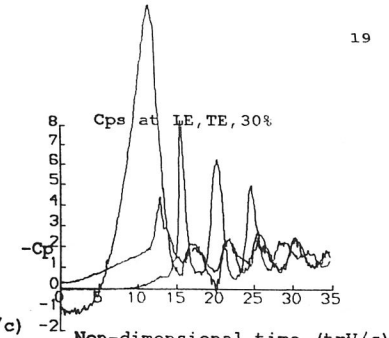
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

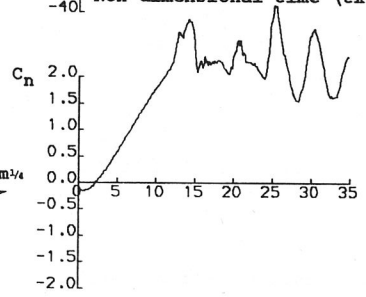
RUN REFERENCE NUMBER: 20192
REYNOLDS NUMBER = 1481165.
DYNAMIC PRESSURE = 1001.97 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

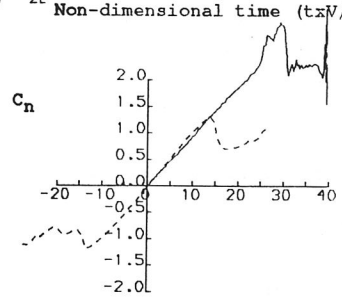
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 24.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02201
LINEAR PITCH RATE = 189.24°S^{-1}

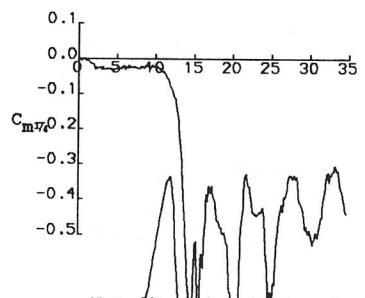


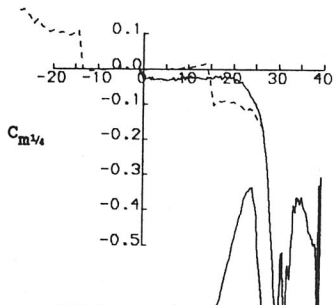


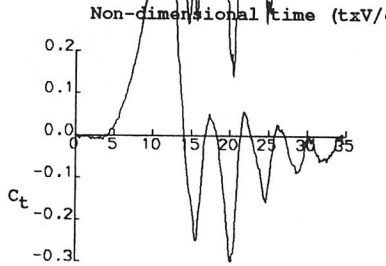


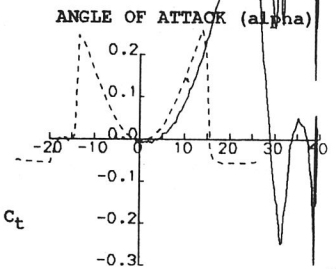








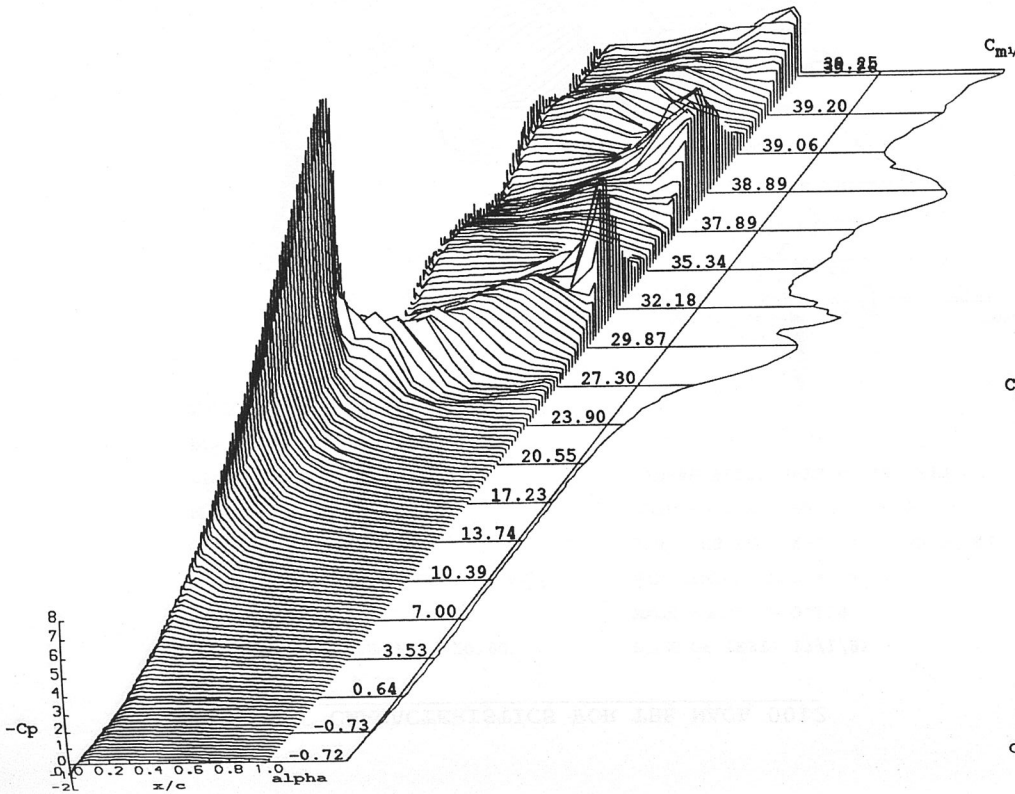


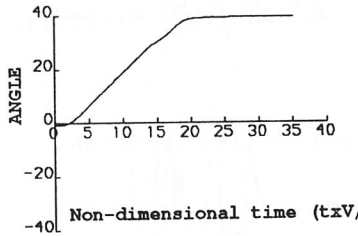


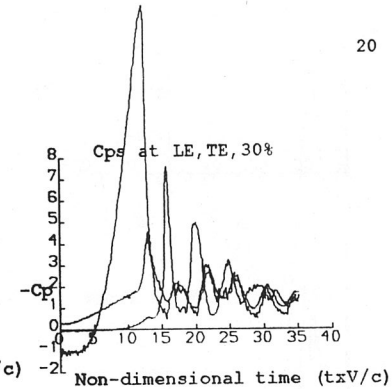
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

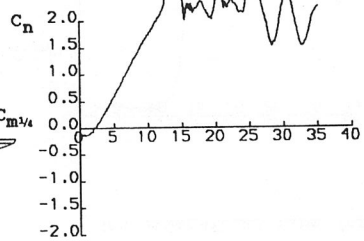
RUN REFERENCE NUMBER: 20202
REYNOLDS NUMBER = 1478617.
DYNAMIC PRESSURE = 1001.97 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

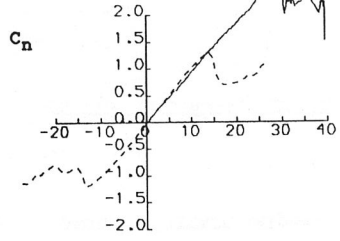
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 24.9°C
SAMPLING FREQUENCY = 544.96 Hz.
REDUCED PITCH RATE = 0.02137
LINEAR PITCH RATE = 183.90°S^{-1}

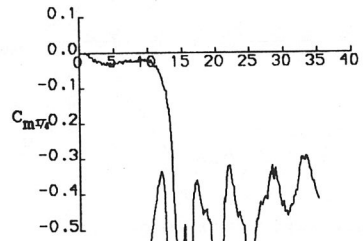


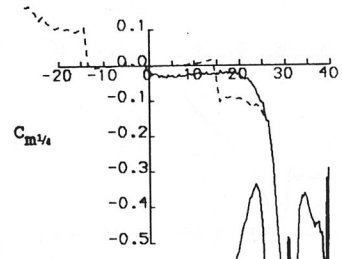


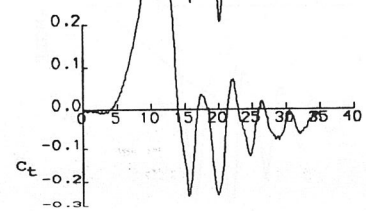


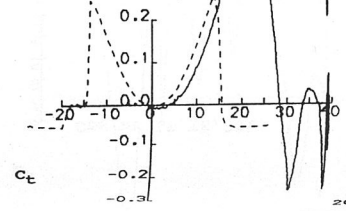








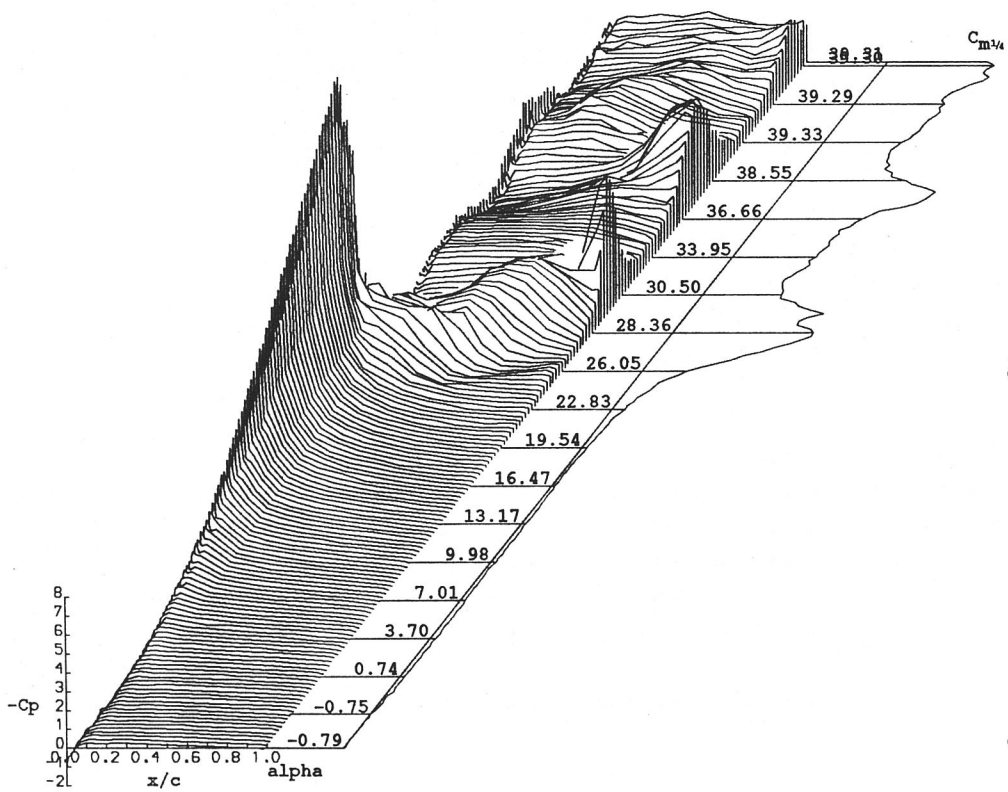


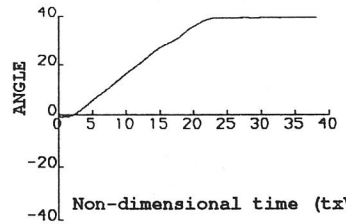


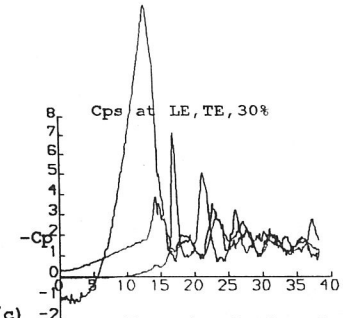
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

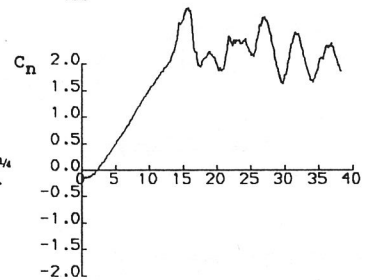
RUN REFERENCE NUMBER: 20212
REYNOLDS NUMBER = 1476711.
DYNAMIC PRESSURE = 1001.97 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

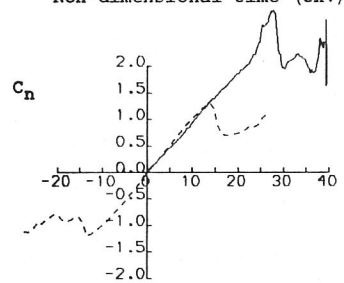
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 25.2°C
SAMPLING FREQUENCY = 500.00 Hz.
REDUCED PITCH RATE = 0.01854
LINEAR PITCH RATE = 159.61°S^{-1}

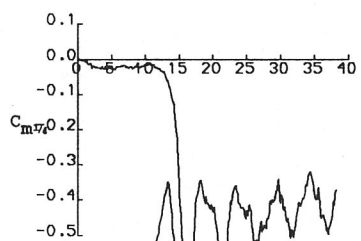


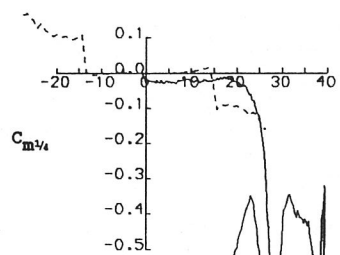


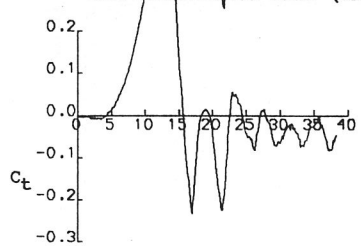


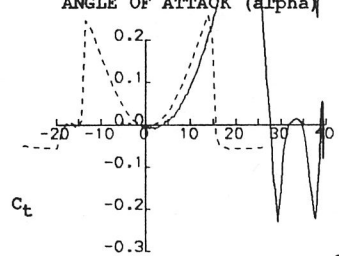








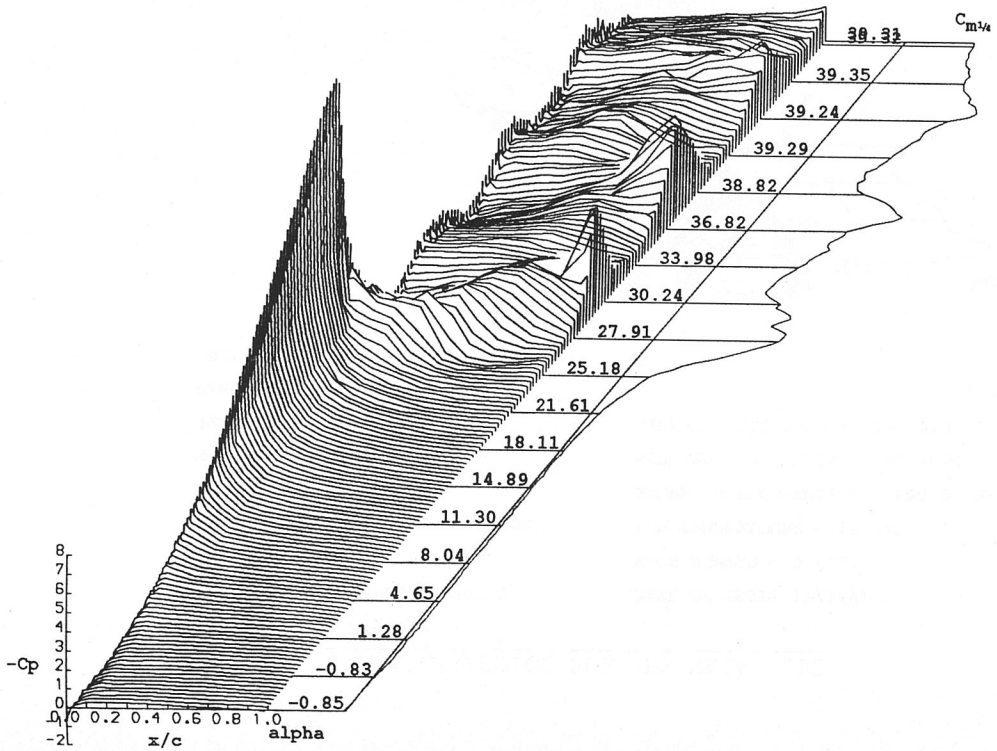


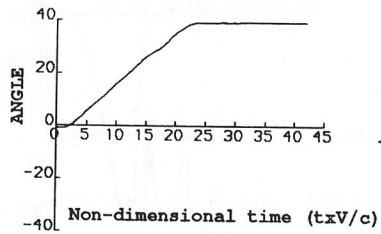


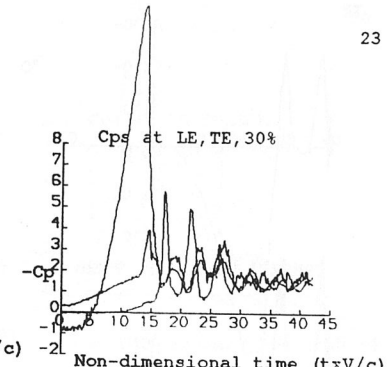
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

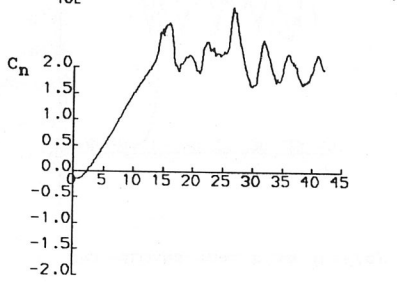
RUN REFERENCE NUMBER: 20232
REYNOLDS NUMBER = 1464416.
DYNAMIC PRESSURE = 982.82 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

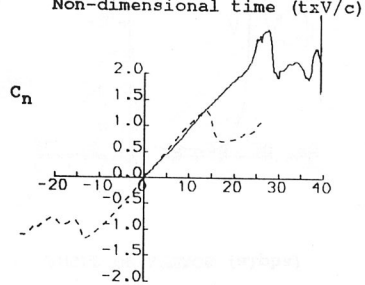
DATE OF TEST: 17/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.9°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01805
LINEAR PITCH RATE = 153.77°S^{-1}

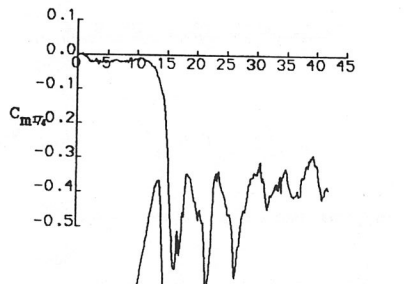


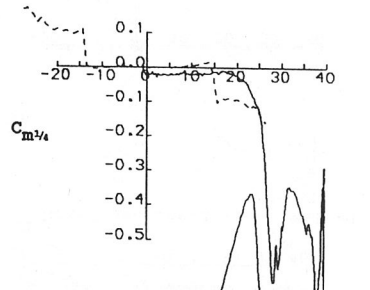


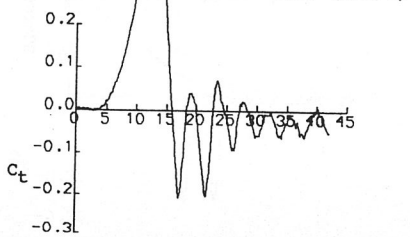


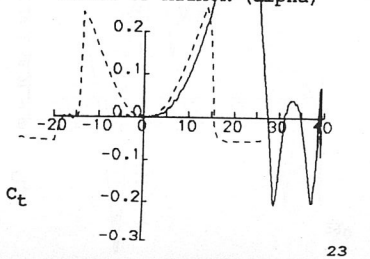








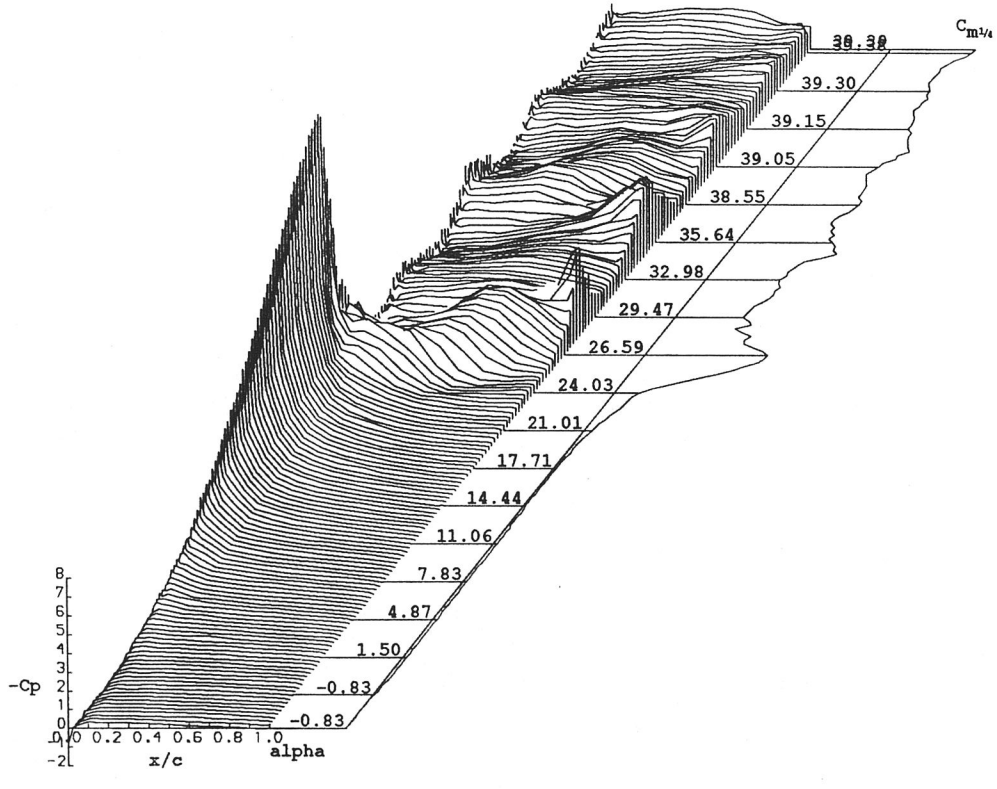


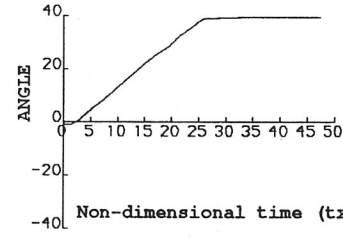


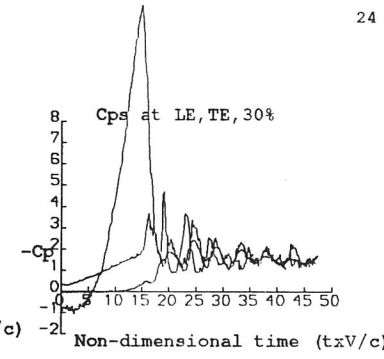
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

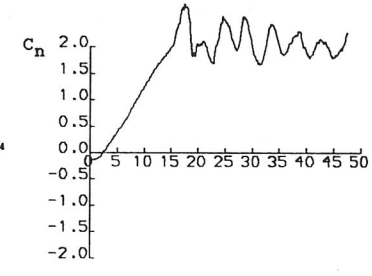
RUN REFERENCE NUMBER: 20242
REYNOLDS NUMBER = 1461901.
DYNAMIC PRESSURE = 982.82 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

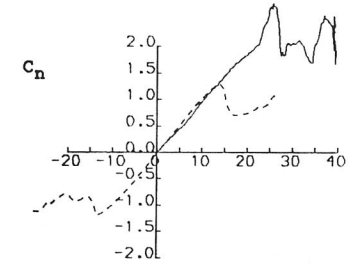
DATE OF TEST: 17/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.3°C
SAMPLING FREQUENCY = 400.00 Hz.
REDUCED PITCH RATE = 0.01558
LINEAR PITCH RATE = 132.81°S^{-1}

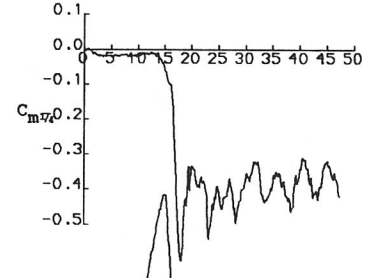


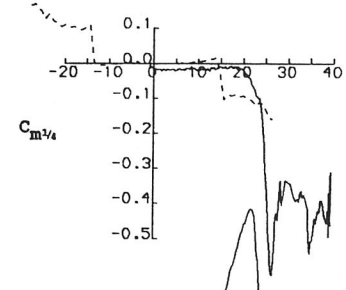


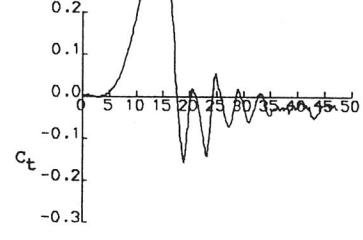


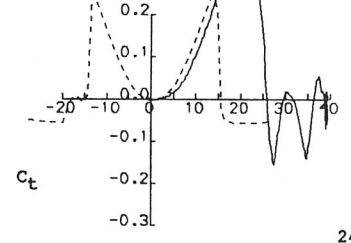








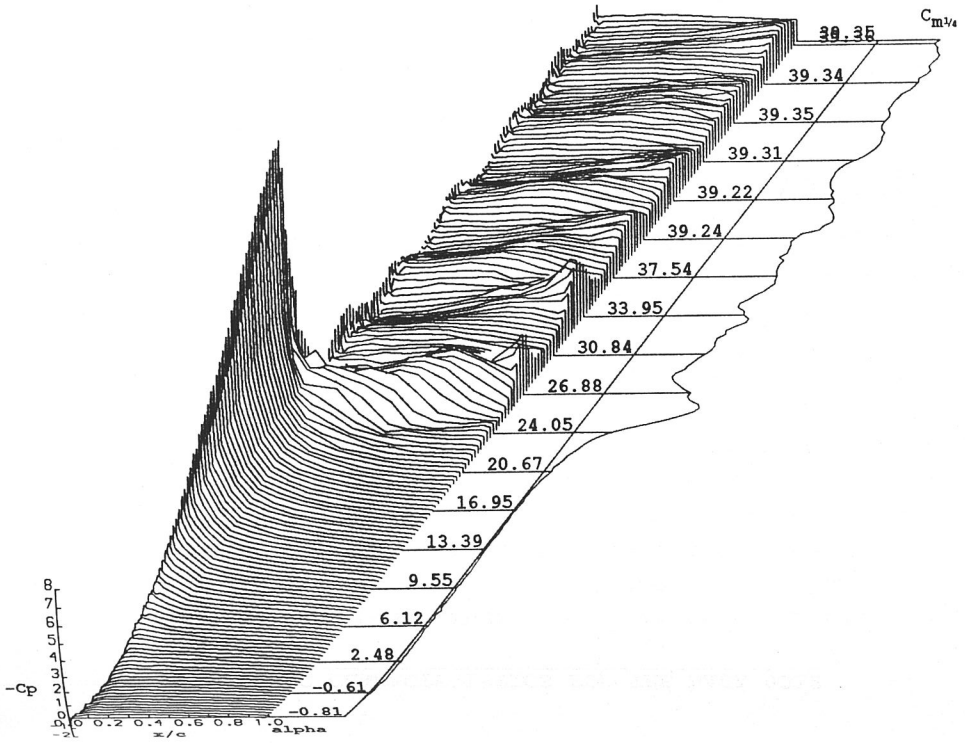


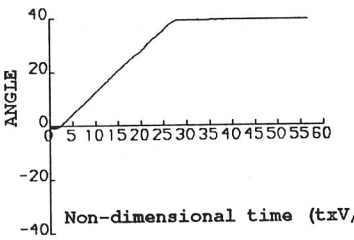


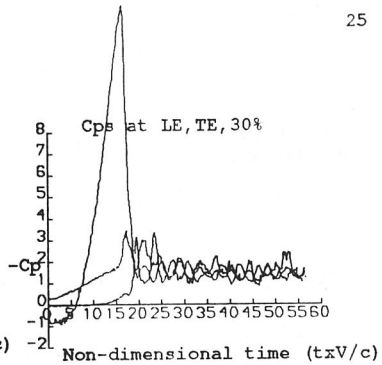
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

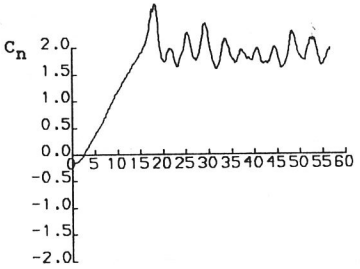
RUN REFERENCE NUMBER: 20252
REYNOLDS NUMBER = 1457519.
DYNAMIC PRESSURE = 982.82 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

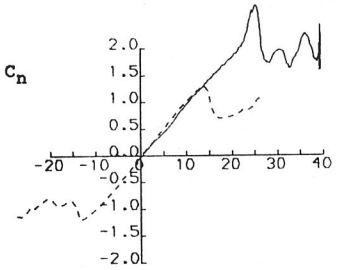
DATE OF TEST: 17/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 26.0°C
SAMPLING FREQUENCY = 335.01 Hz.
REDUCED PITCH RATE = 0.01455
LINEAR PITCH RATE = 124.18°S^{-1}

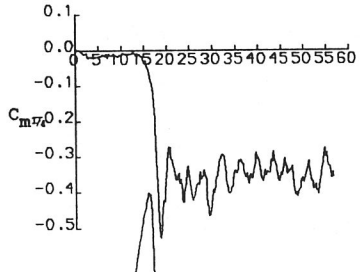


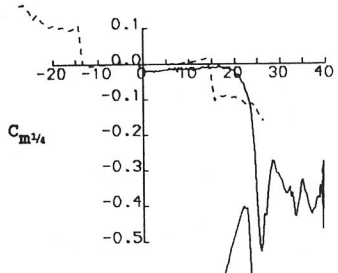


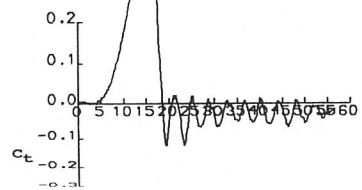


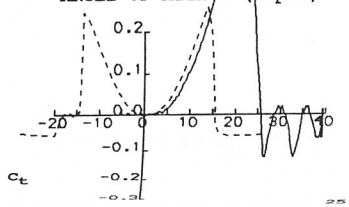






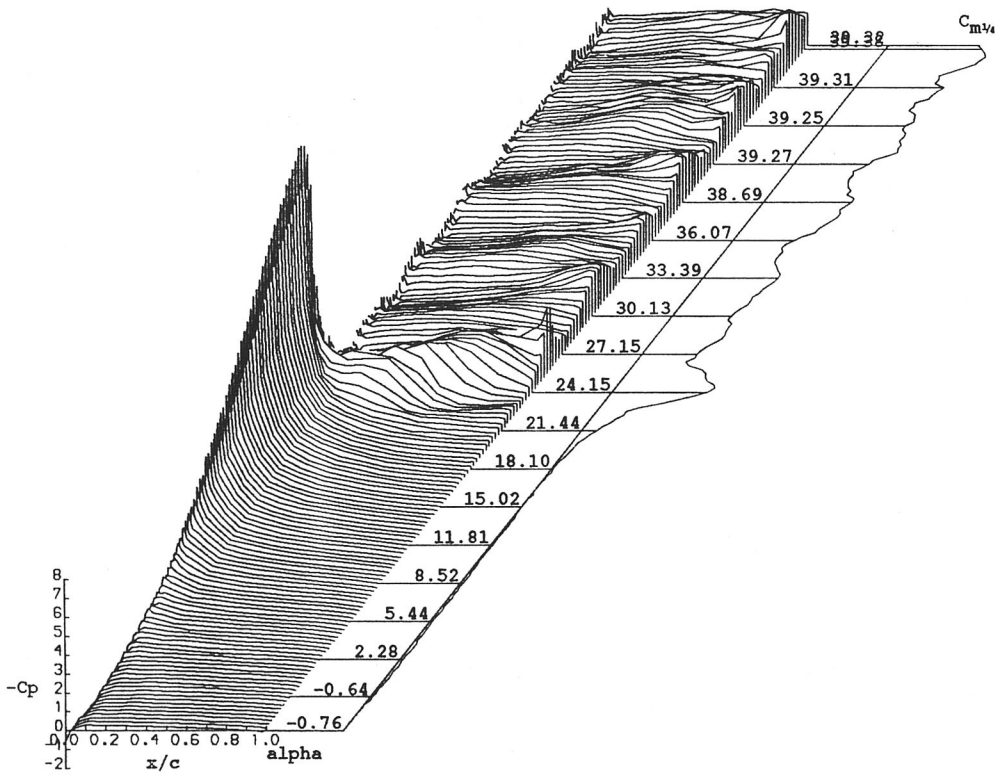


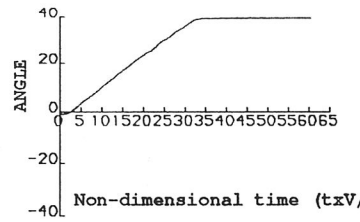


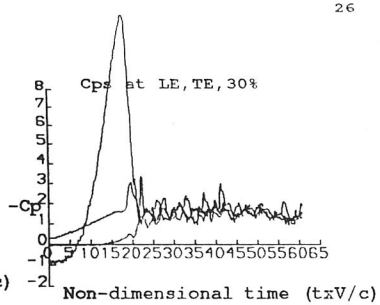


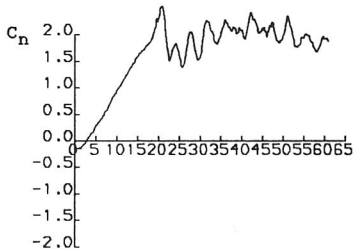
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

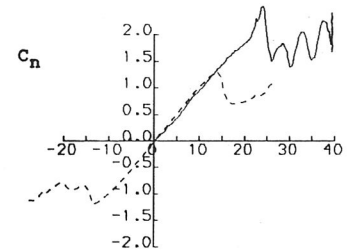
RUN REFERENCE NUMBER: 20262
DATE OF TEST: 17/1/91
REYNOLDS NUMBER = 1455649.
MACH NUMBER = 0.118
DYNAMIC PRESSURE = 982.82 Nm^{-2}
AIR TEMPERATURE = 26.3°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 312.01 Hz.
MOTION TYPE: RAMP UP
REDUCED PITCH RATE = 0.01159
START ANGLE = -1.00°
LINEAR PITCH RATE = 99.02°S^{-1}
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

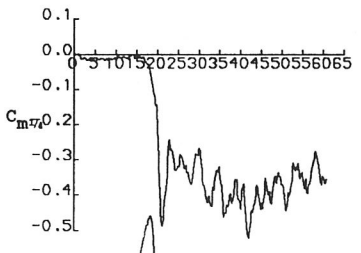


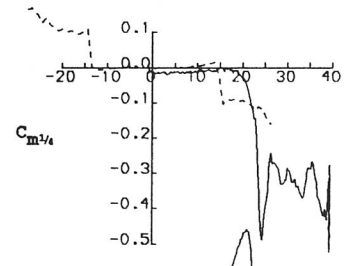


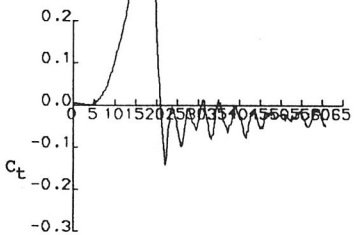


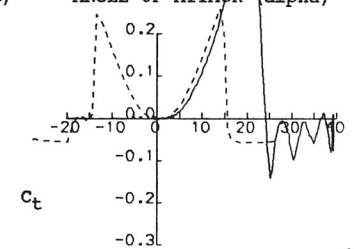








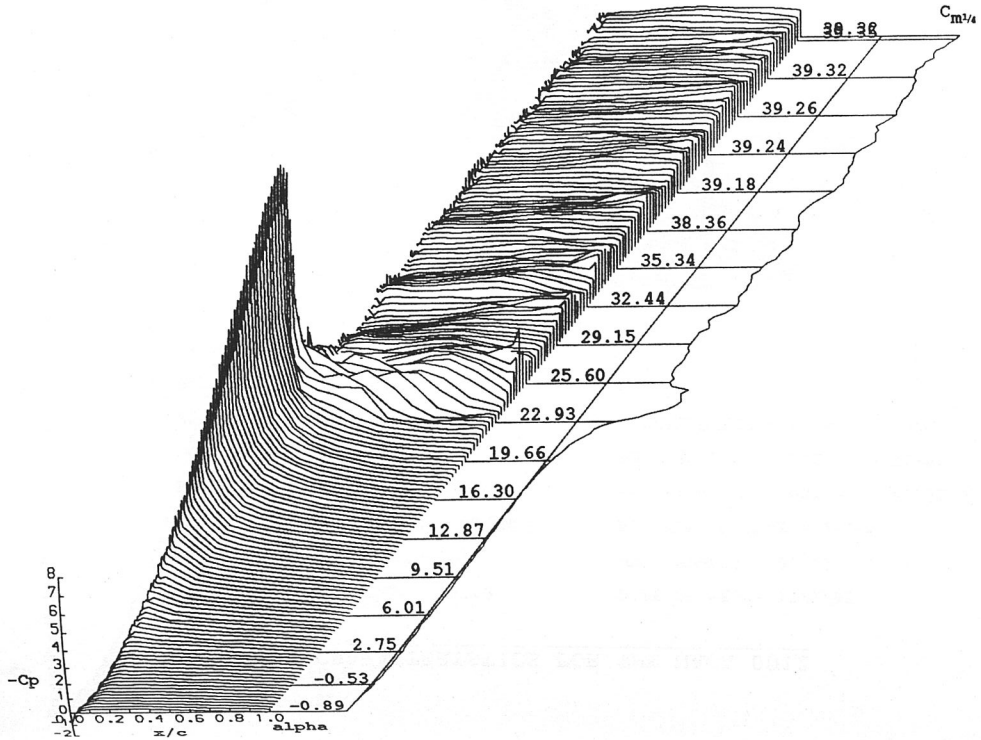


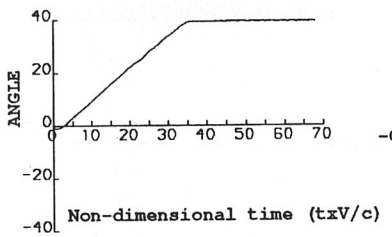


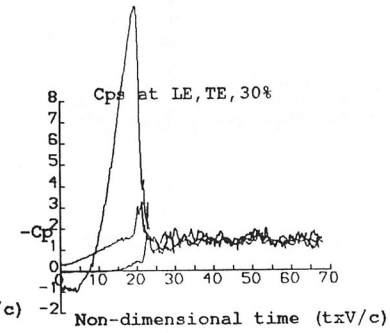
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

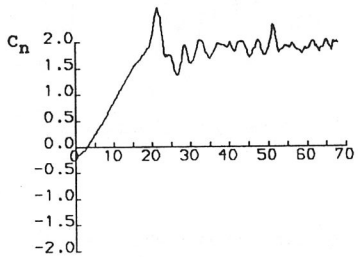
RUN REFERENCE NUMBER: 20272
REYNOLDS NUMBER = 1485890.
DYNAMIC PRESSURE = 1000.26 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

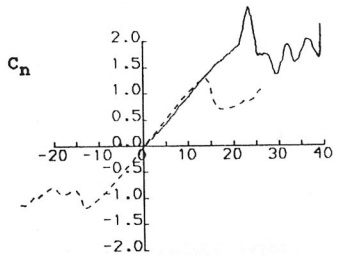
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 23.9°C
SAMPLING FREQUENCY = 280.03 Hz.
REDUCED PITCH RATE = 0.01103
LINEAR PITCH RATE = 94.50°S^{-1}

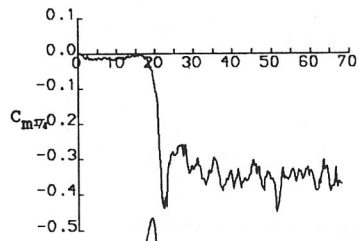


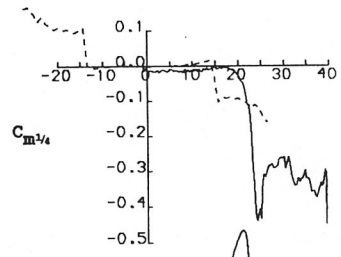


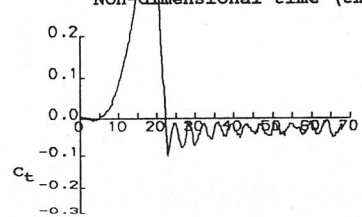


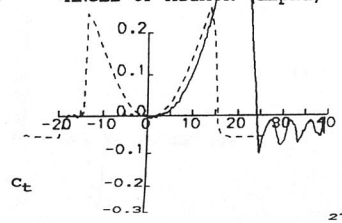








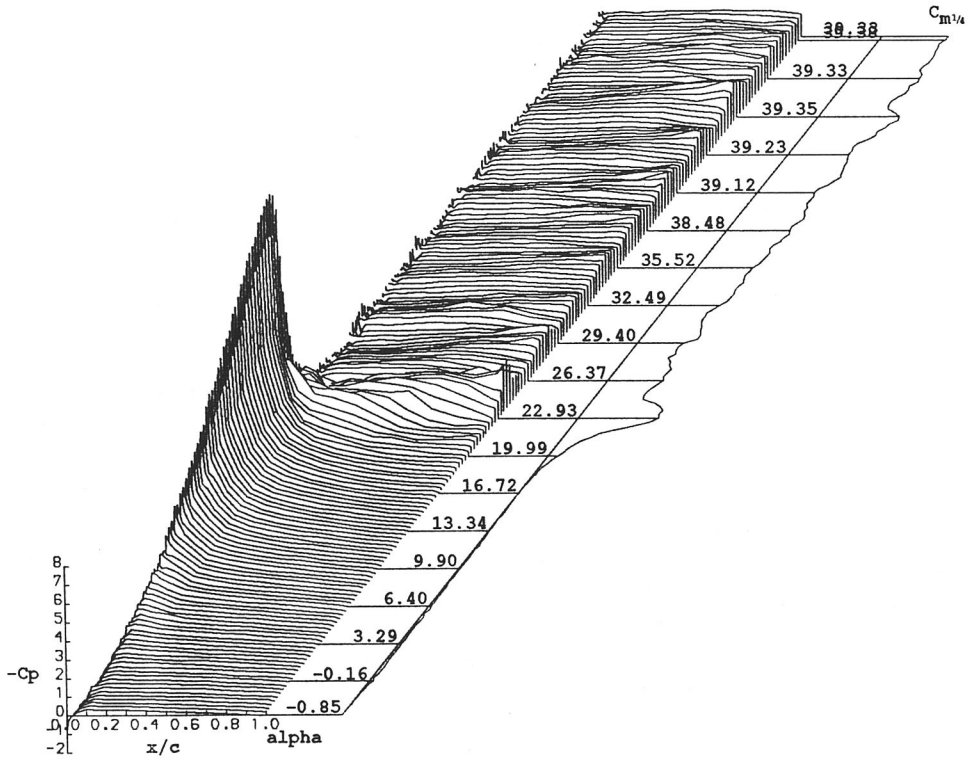


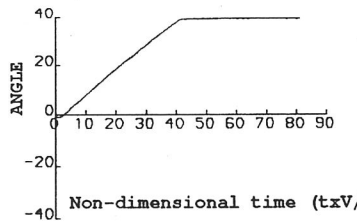


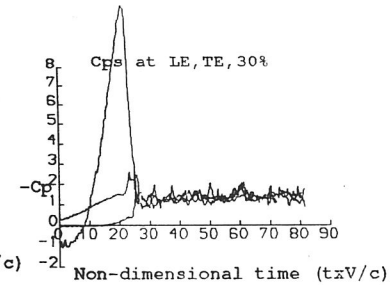
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

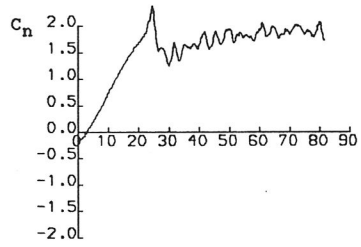
RUN REFERENCE NUMBER: 20282
REYNOLDS NUMBER = 1478865.
DYNAMIC PRESSURE = 1000.26 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

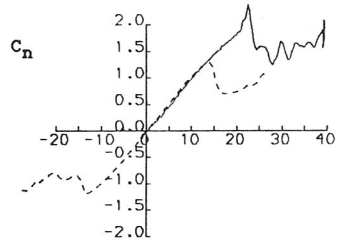
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 25.0°C
SAMPLING FREQUENCY = 233.97 Hz.
REDUCED PITCH RATE = 0.00906
LINEAR PITCH RATE = 77.82°S^{-1}

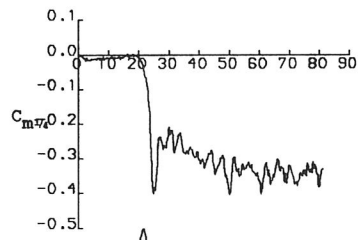


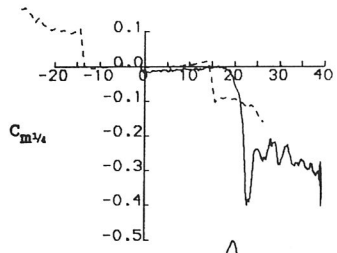


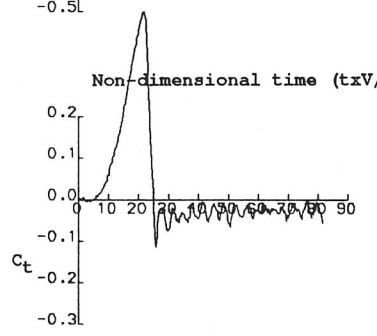


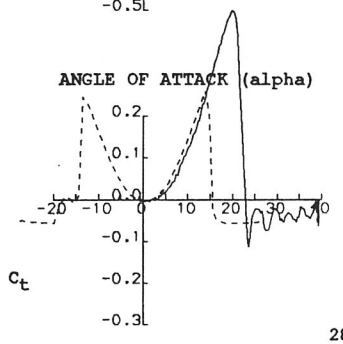








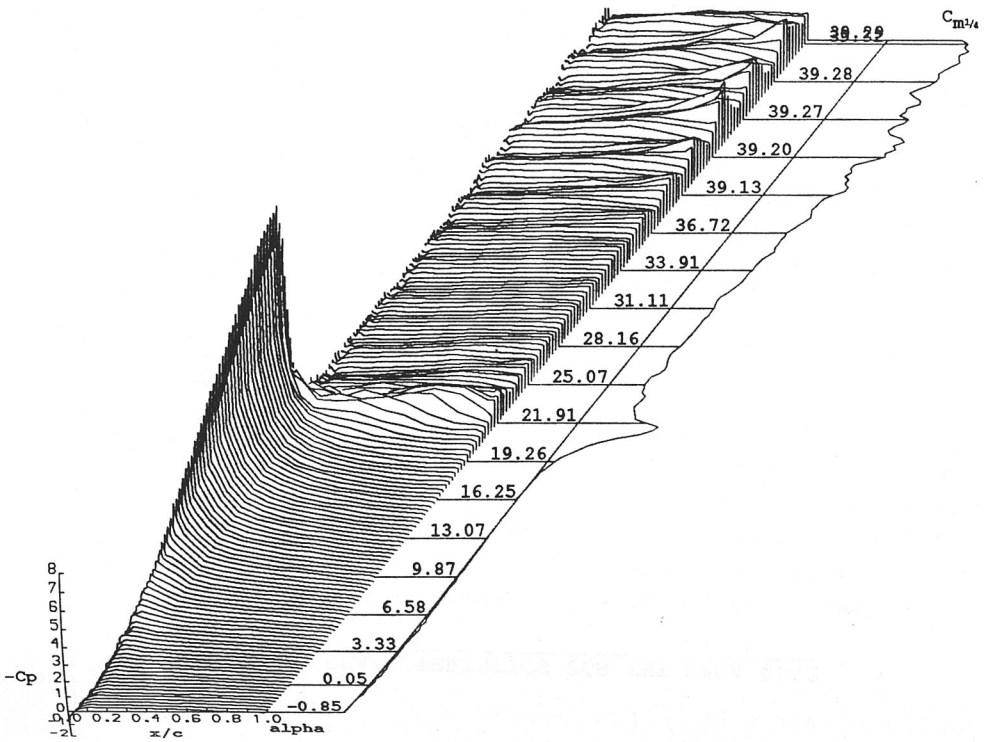


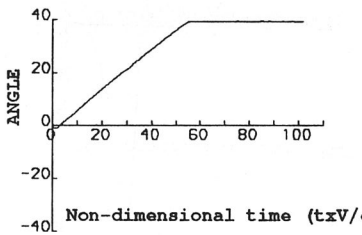


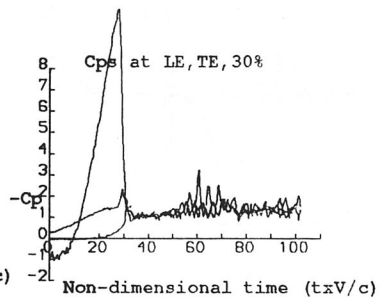
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

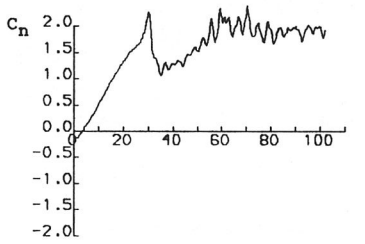
RUN REFERENCE NUMBER: 20292
REYNOLDS NUMBER = 1476326.
DYNAMIC PRESSURE = 1000.26 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

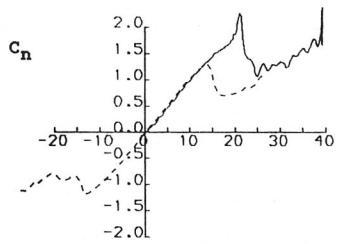
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 25.4°C
SAMPLING FREQUENCY = 186.99 Hz.
REDUCED PITCH RATE = 0.00678
LINEAR PITCH RATE = 58.21°S^{-1}

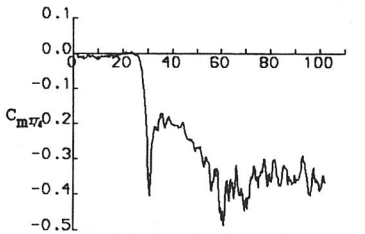


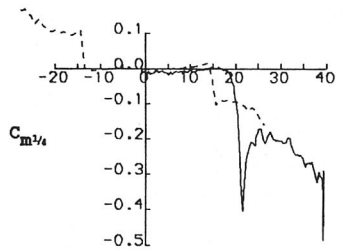


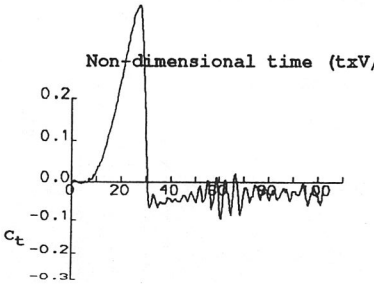


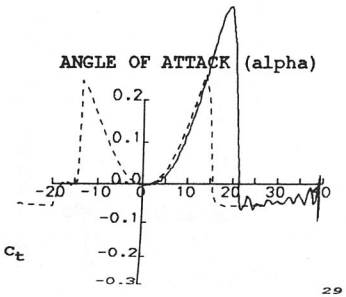








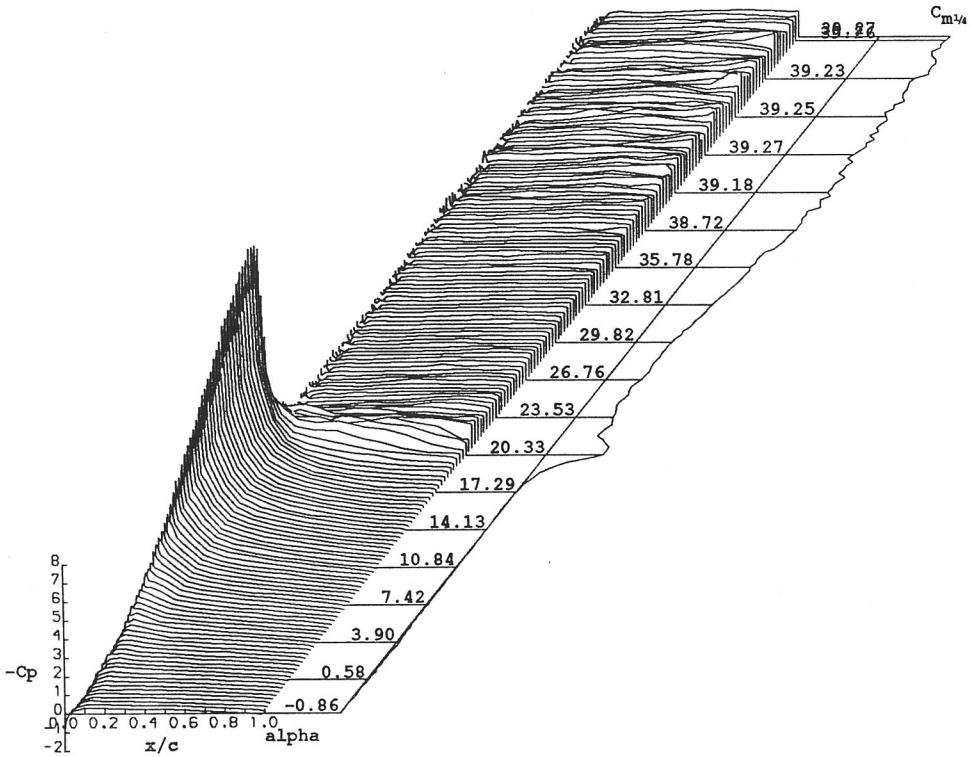


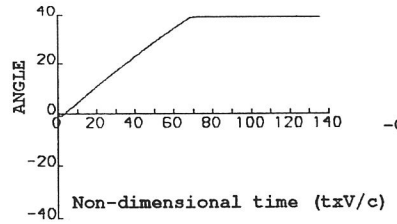


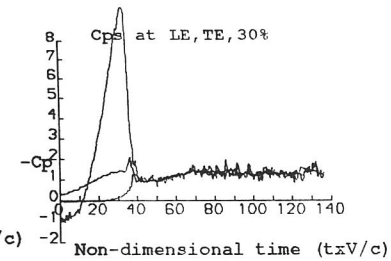
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

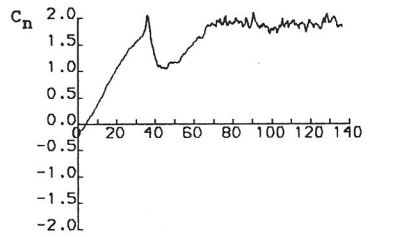
RUN REFERENCE NUMBER: 20302
REYNOLDS NUMBER = 1473795.
DYNAMIC PRESSURE = 1000.26 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

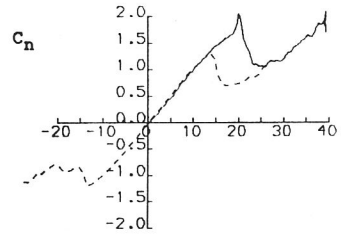
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 25.8°C
SAMPLING FREQUENCY = 140.00 Hz.
REDUCED PITCH RATE = 0.00527
LINEAR PITCH RATE = 45.33°S^{-1}

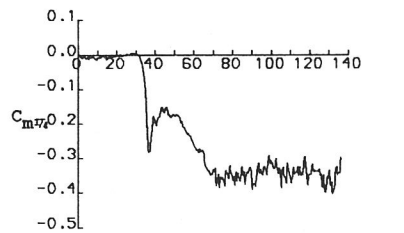


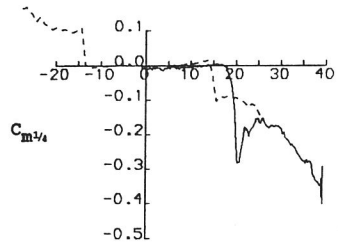


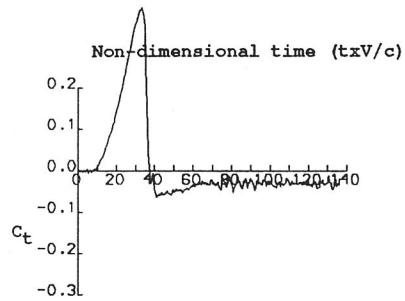


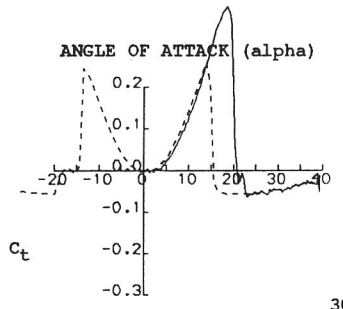








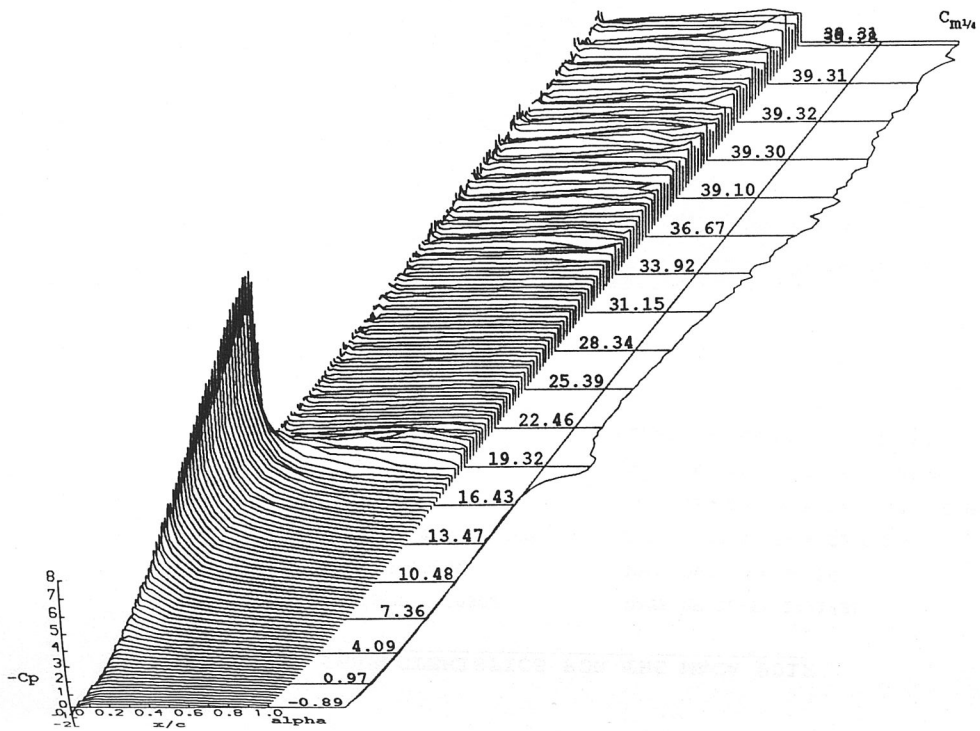


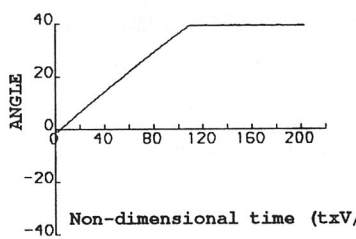


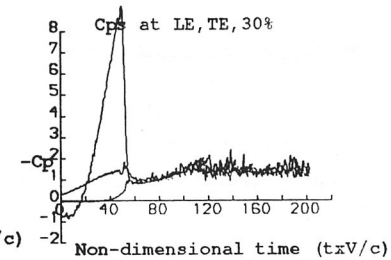
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

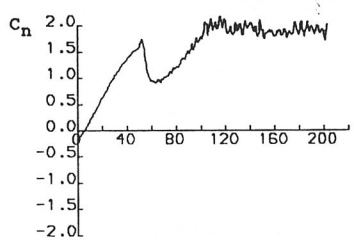
RUN REFERENCE NUMBER: 20312
REYNOLDS NUMBER = 1471615.
DYNAMIC PRESSURE = 992.18 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

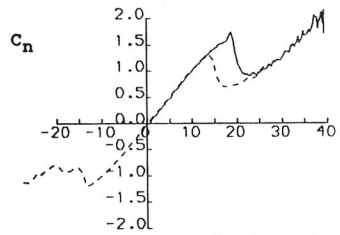
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 25.2°C
SAMPLING FREQUENCY = 93.70 Hz.
REDUCED PITCH RATE = 0.00327
LINEAR PITCH RATE = 27.99°S^{-1}

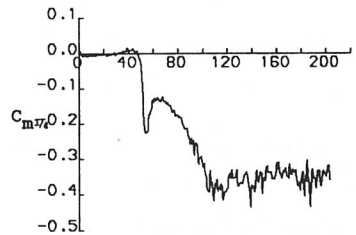


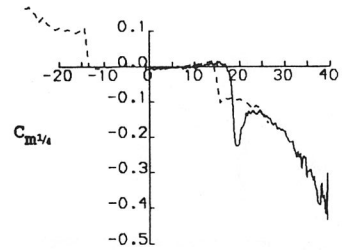


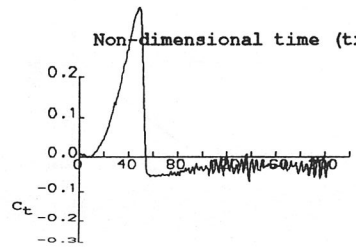


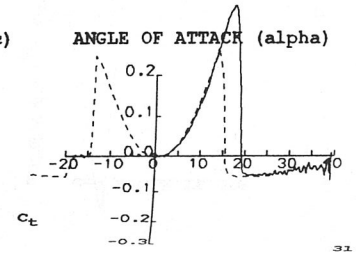








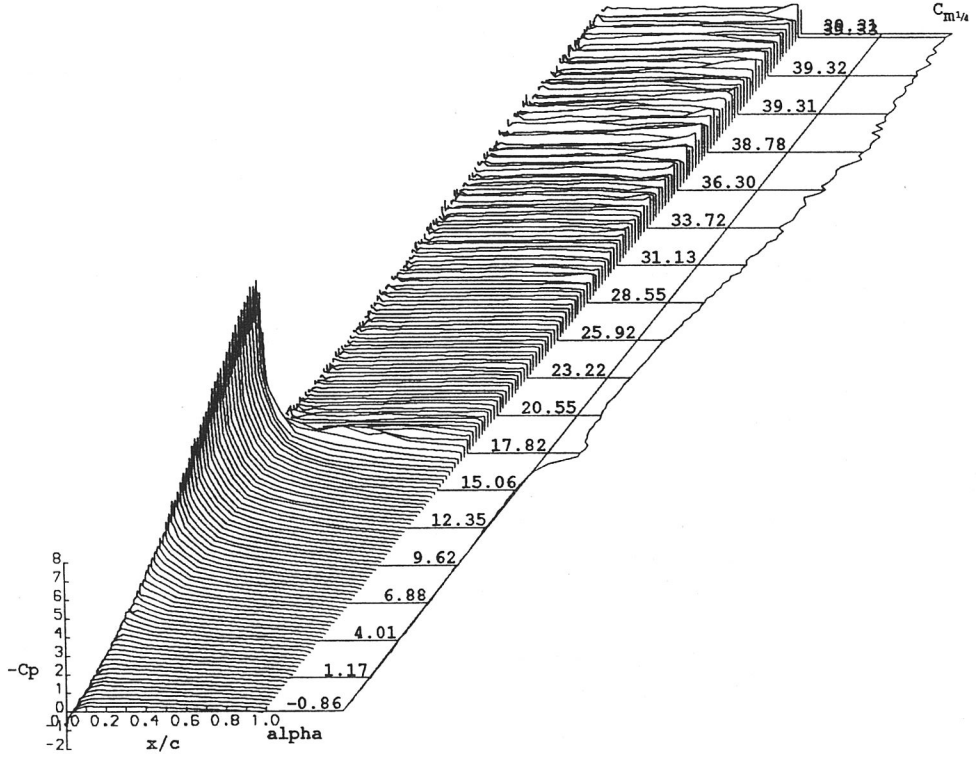


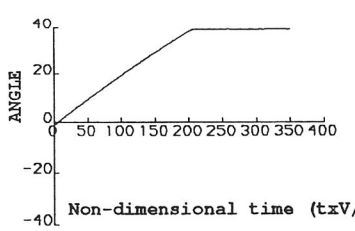


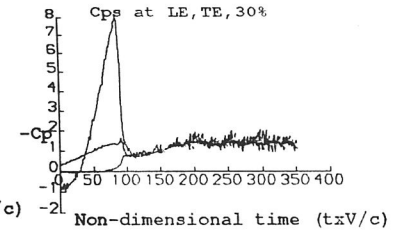
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

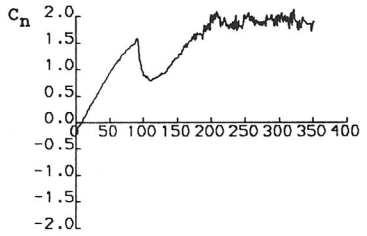
RUN REFERENCE NUMBER: 20322
REYNOLDS NUMBER = 1465319.
DYNAMIC PRESSURE = 992.18 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

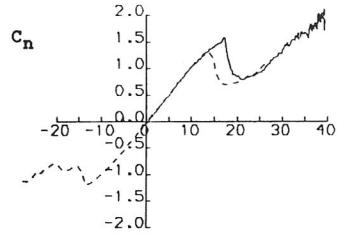
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 26.2°C
SAMPLING FREQUENCY = 54.10 Hz.
REDUCED PITCH RATE = 0.00171
LINEAR PITCH RATE = 14.68°S^{-1}

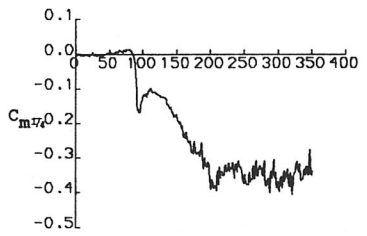


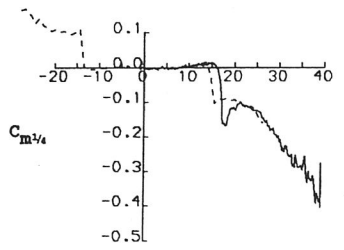


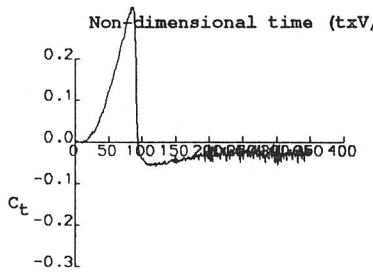


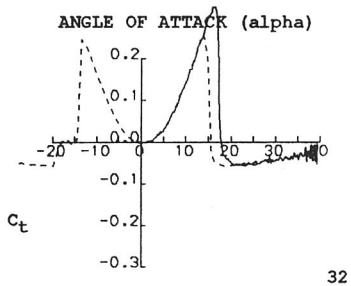








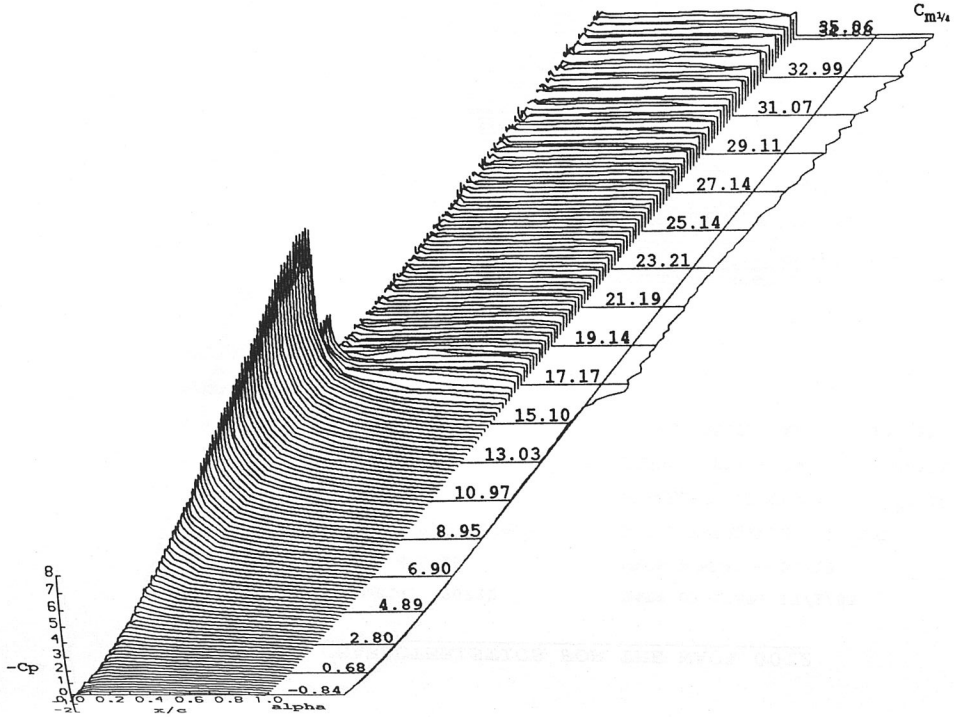


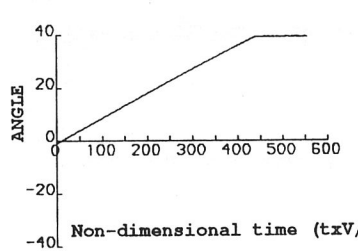


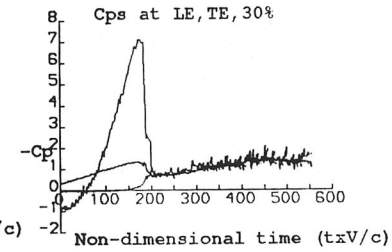
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

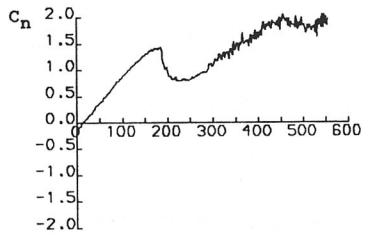
RUN REFERENCE NUMBER: 20332
REYNOLDS NUMBER = 1462815.
DYNAMIC PRESSURE = 992.18 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

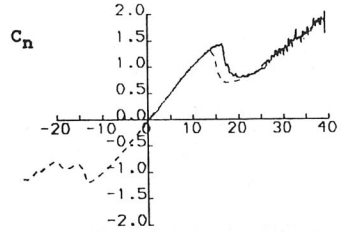
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 26.6°C
SAMPLING FREQUENCY = 34.30 Hz.
REDUCED PITCH RATE = 0.00081
LINEAR PITCH RATE = 6.93°S^{-1}

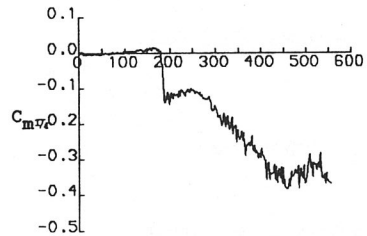


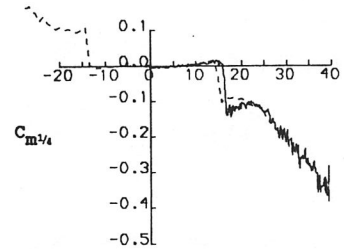


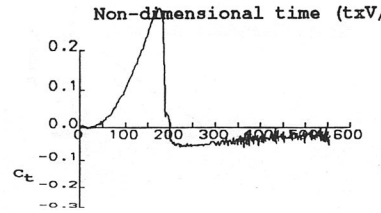


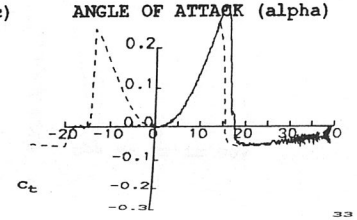








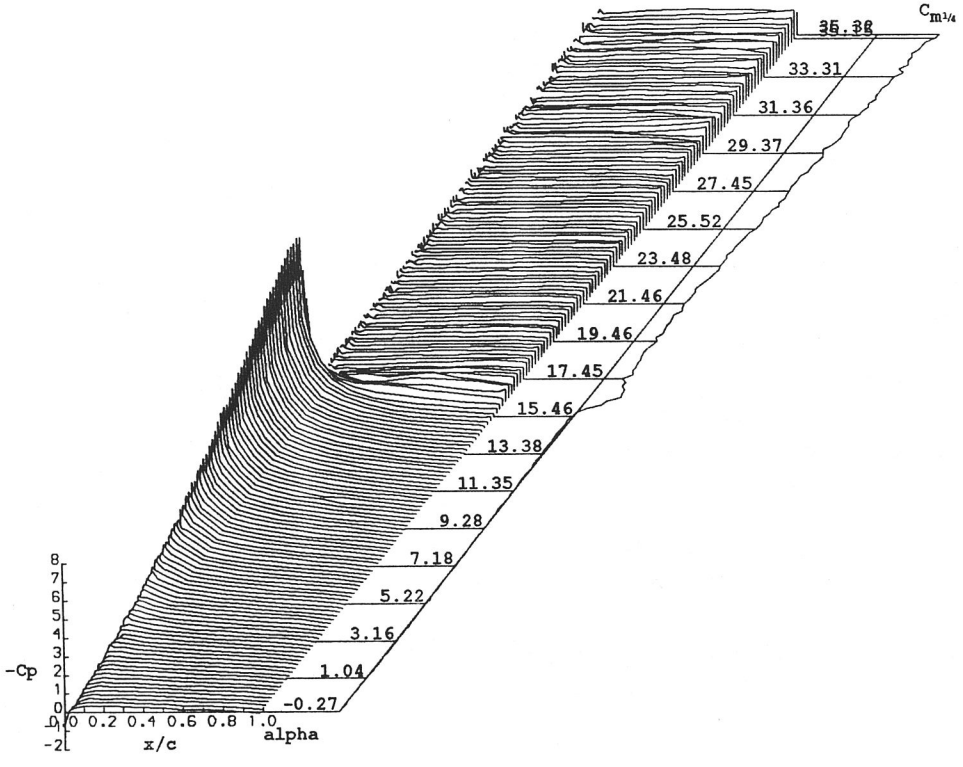


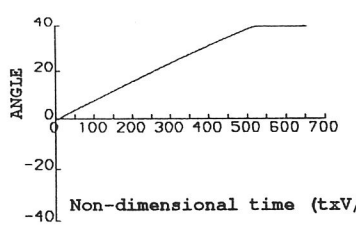


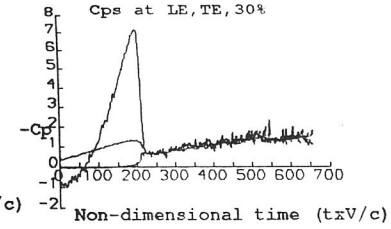
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

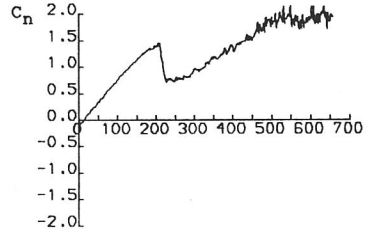
RUN REFERENCE NUMBER: 20342
REYNOLDS NUMBER = 1458452.
DYNAMIC PRESSURE = 992.18 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

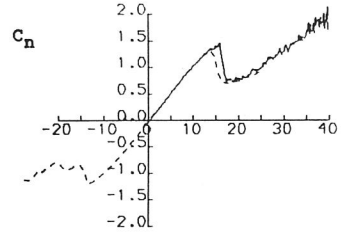
DATE OF TEST: 17/1/91
MACH NUMBER = 0.119
AIR TEMPERATURE = 27.3°C
SAMPLING FREQUENCY = 29.00 Hz.
REDUCED PITCH RATE = 0.00069
LINEAR PITCH RATE = 5.89°S^{-1}

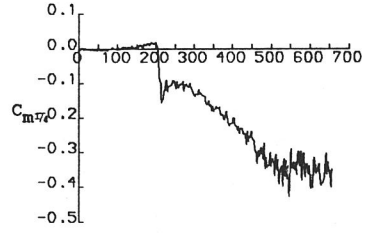


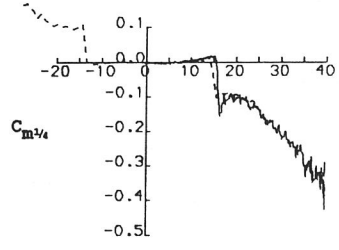


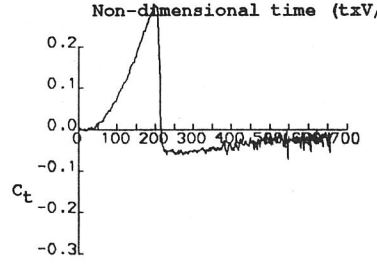


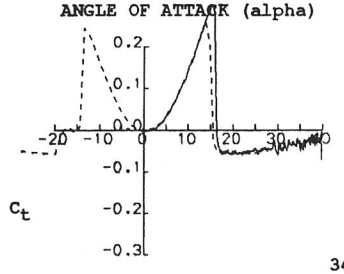








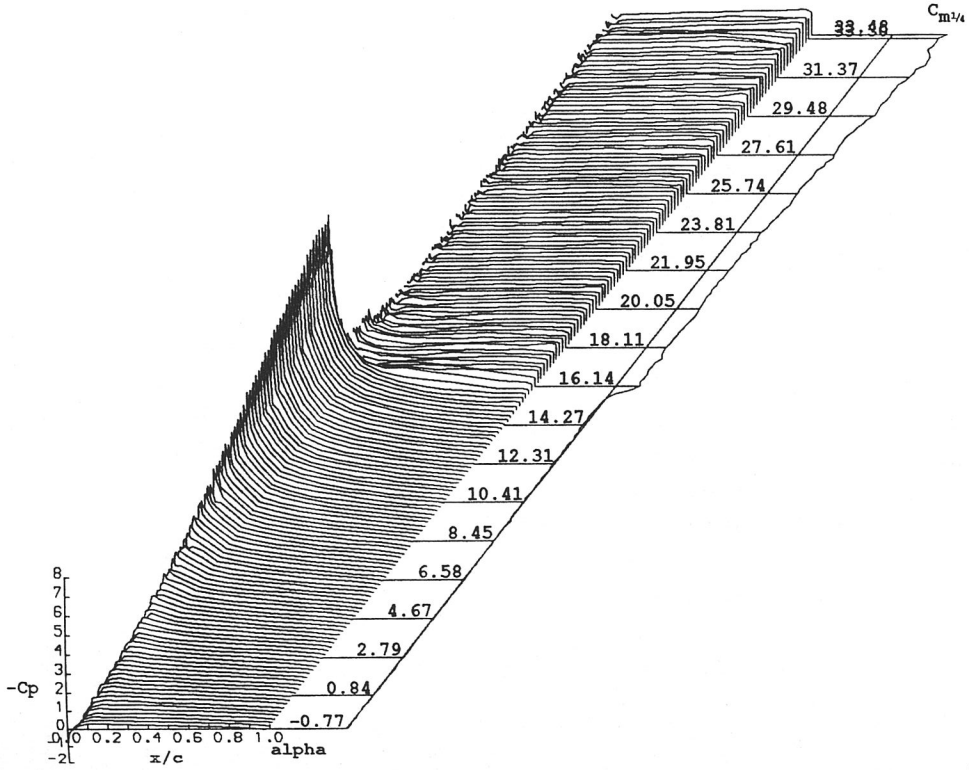


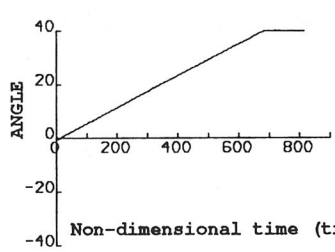


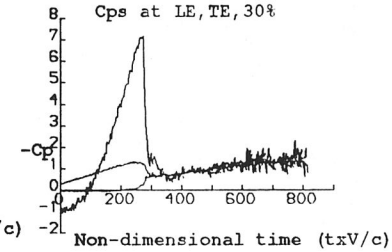
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

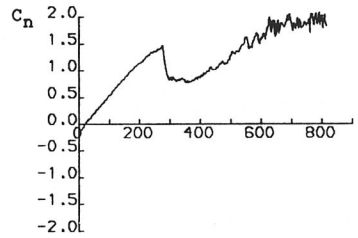
RUN REFERENCE NUMBER: 20352
REYNOLDS NUMBER = 1524415.
DYNAMIC PRESSURE = 1005.14 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

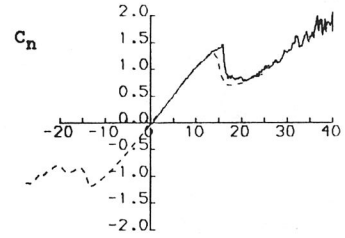
DATE OF TEST: 22/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 22.1°C
SAMPLING FREQUENCY = 23.00 Hz.
REDUCED PITCH RATE = 0.00051
LINEAR PITCH RATE = 4.33°S^{-1}

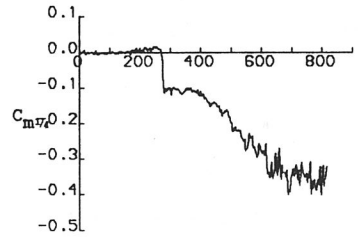


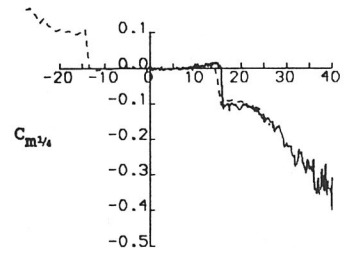


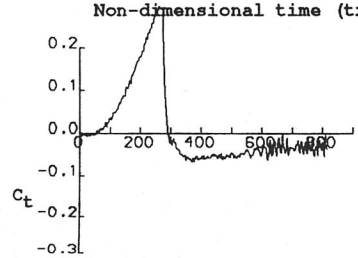


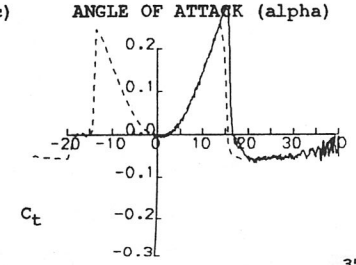








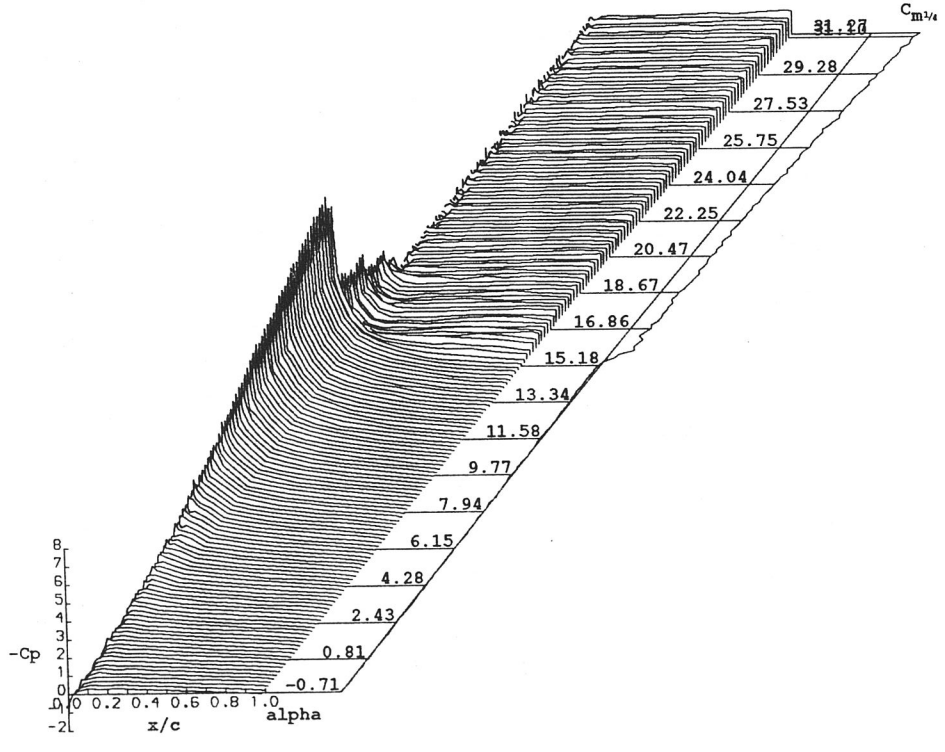


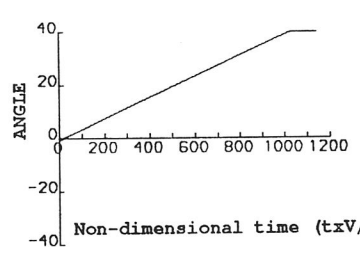


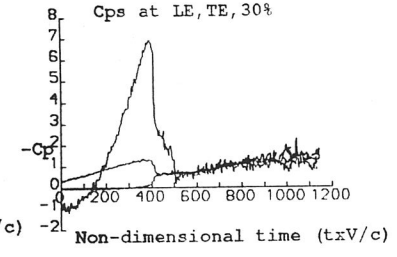
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

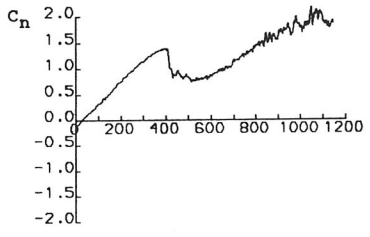
RUN REFERENCE NUMBER: 20362
REYNOLDS NUMBER = 1519789.
DYNAMIC PRESSURE = 1005.14 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

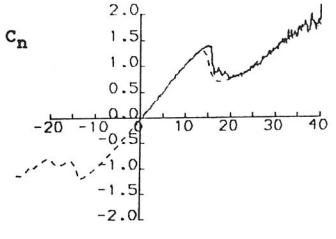
DATE OF TEST: 22/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 22.8°C
SAMPLING FREQUENCY = 16.40 Hz.
REDUCED PITCH RATE = 0.00034
LINEAR PITCH RATE = 2.90°S^{-1}

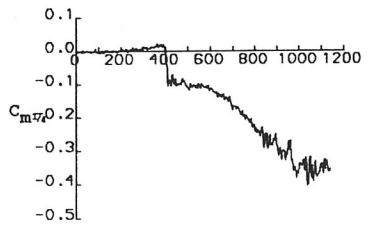


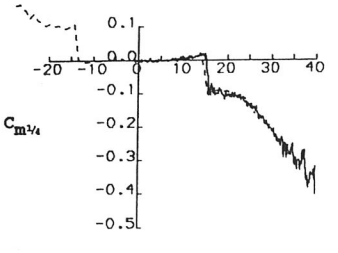


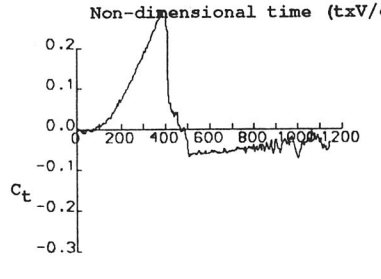


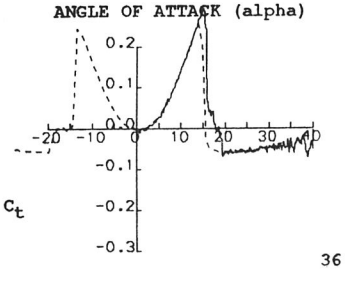








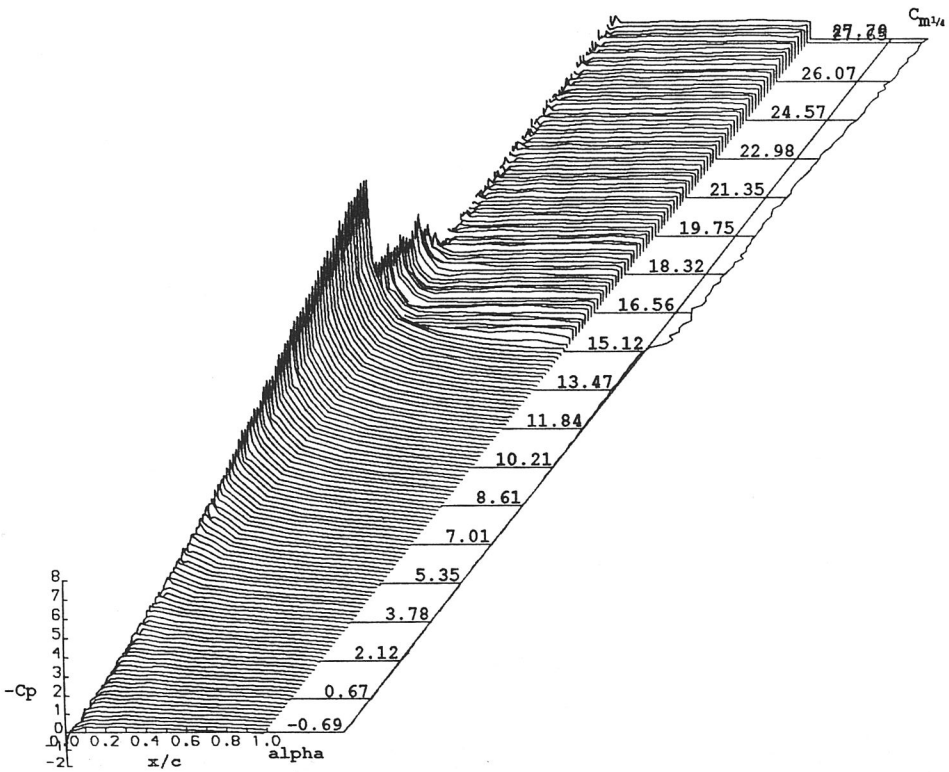


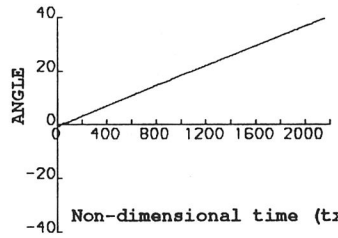


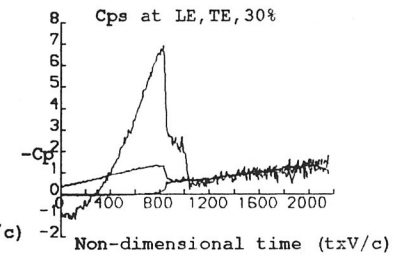
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

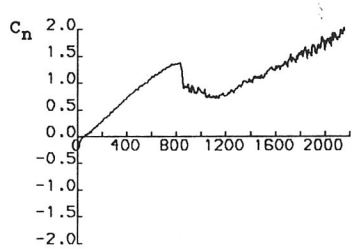
RUN REFERENCE NUMBER: 20372
REYNOLDS NUMBER = 1514534.
DYNAMIC PRESSURE = 1005.14 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

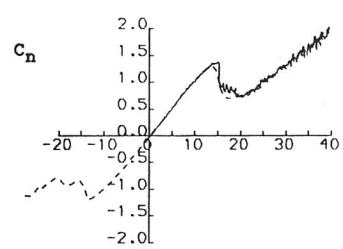
DATE OF TEST: 22/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.6°C
SAMPLING FREQUENCY = 8.70 Hz.
REDUCED PITCH RATE = 0.00016
LINEAR PITCH RATE = 1.38°S^{-1}

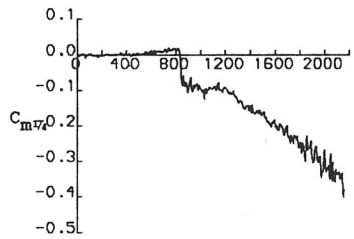


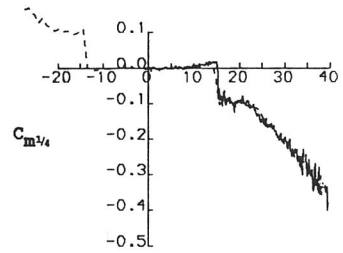


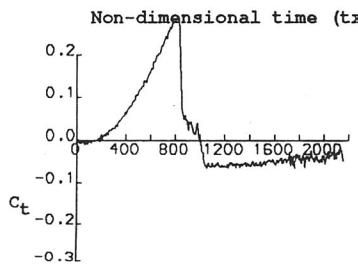


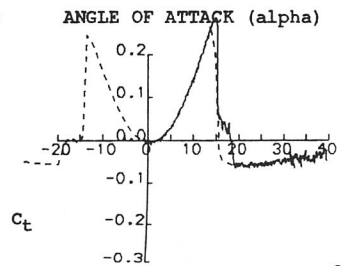








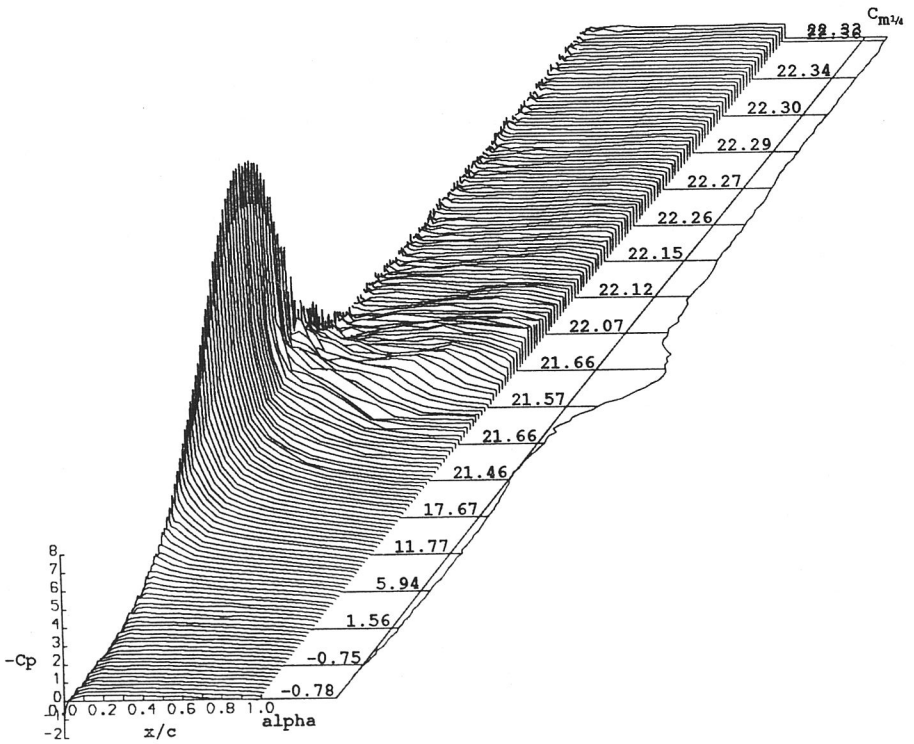


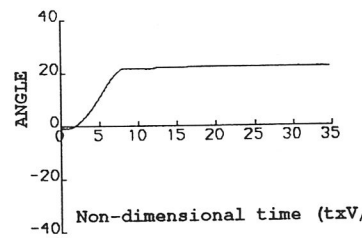


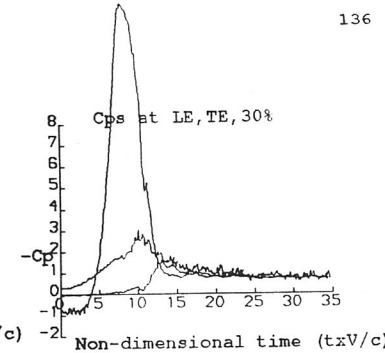
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

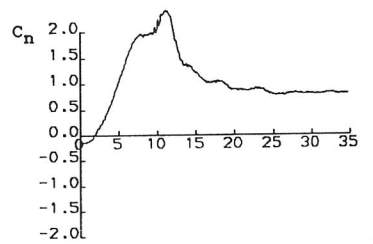
RUN REFERENCE NUMBER: 21361
REYNOLDS NUMBER = 1527295.
DYNAMIC PRESSURE = 1023.16 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 23.000°
AVERAGED DATA OF 5 CYCLES

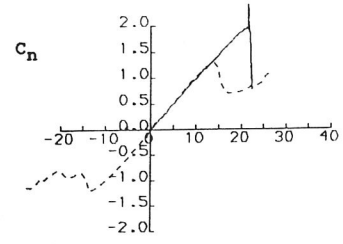
DATE OF TEST: 16/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 21.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03634
LINEAR PITCH RATE = 312.14°S^{-1}

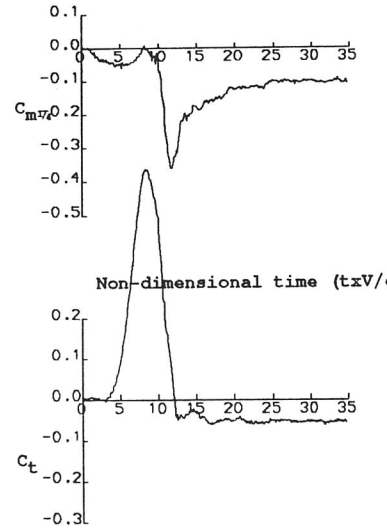


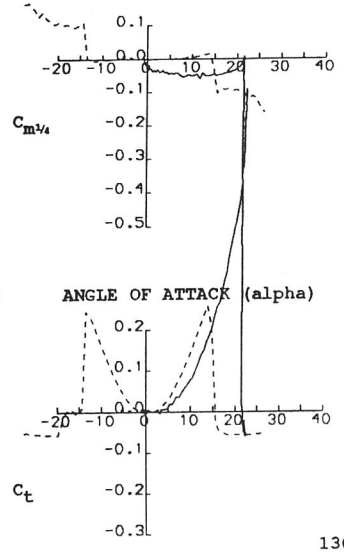








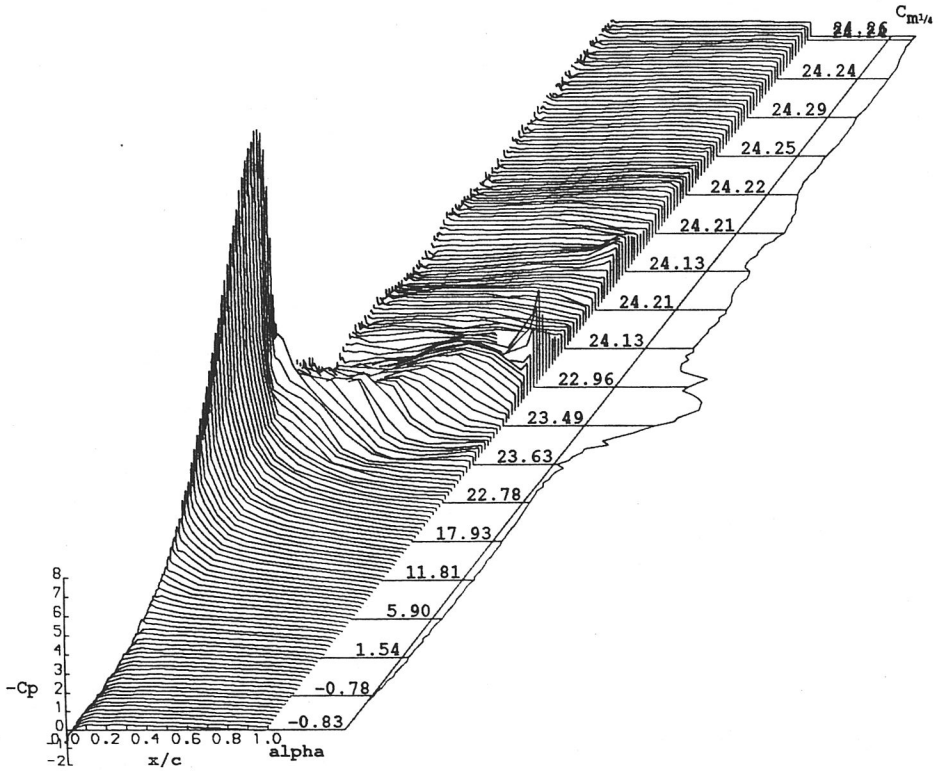


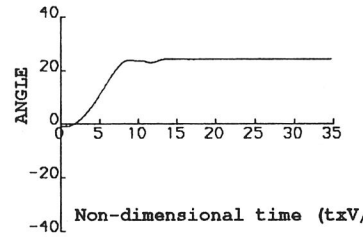


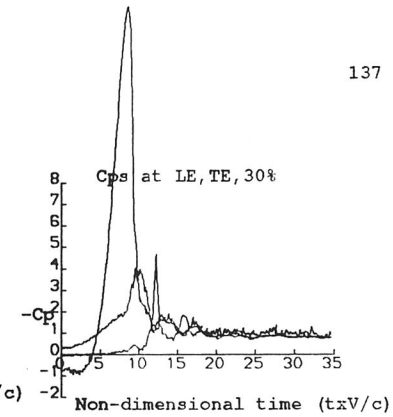
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

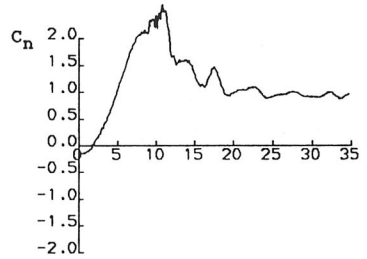
RUN REFERENCE NUMBER: 21371
REYNOLDS NUMBER = 1520658.
DYNAMIC PRESSURE = 1023.16 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 25.000°
AVERAGED DATA OF 5 CYCLES

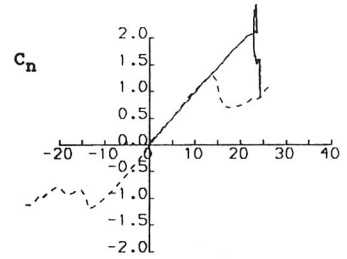
DATE OF TEST: 16/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 22.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03791
LINEAR PITCH RATE = 326.16°S^{-1}

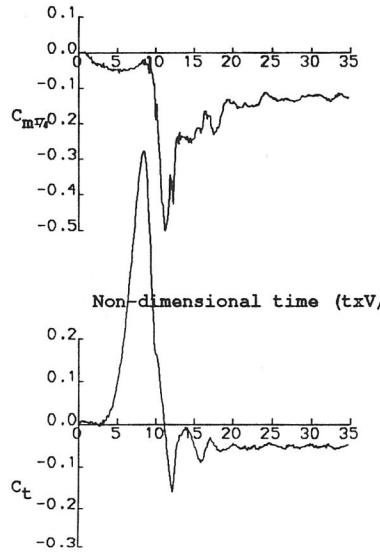


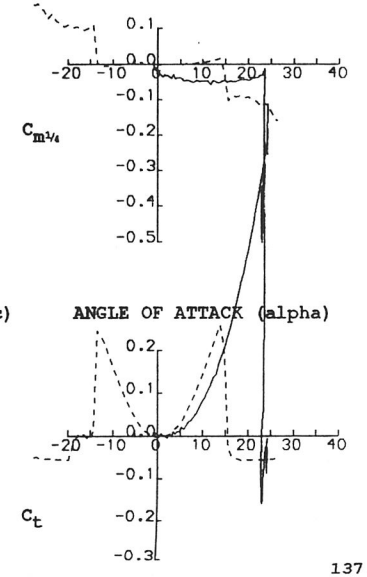








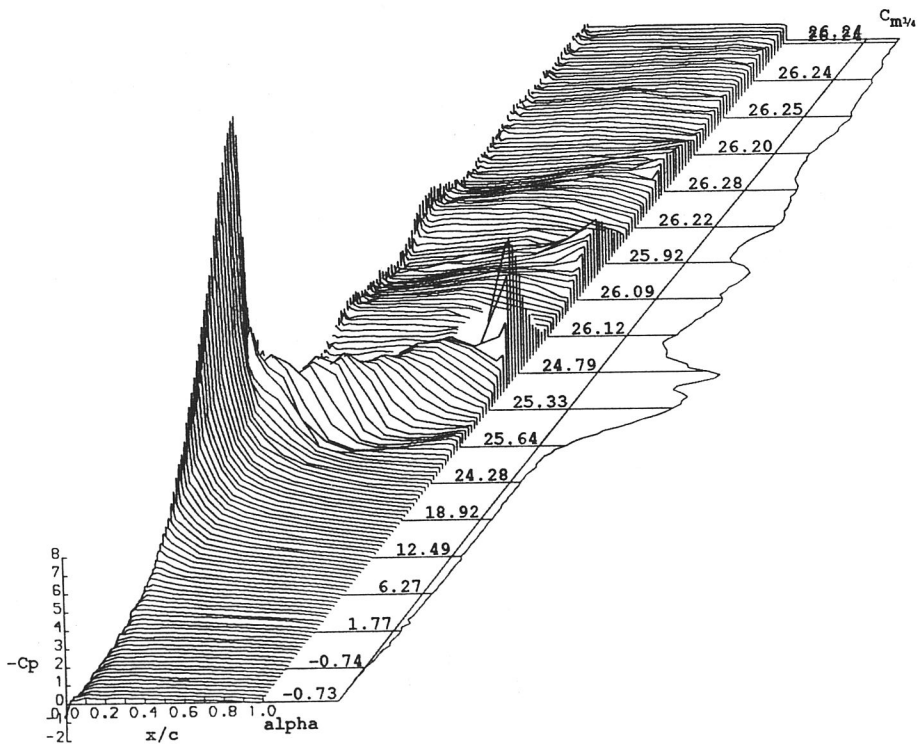


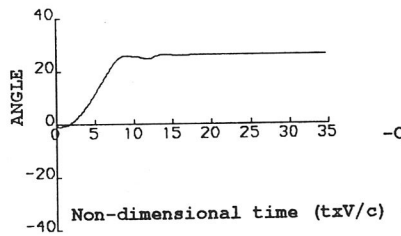


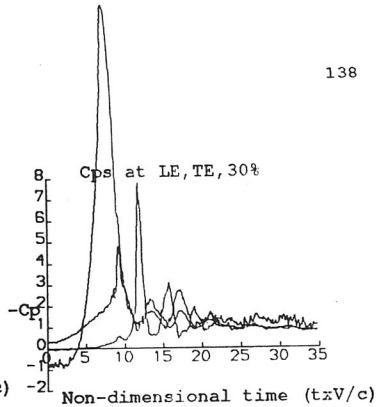
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

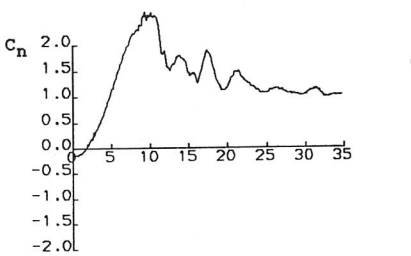
RUN REFERENCE NUMBER: 21381
REYNOLDS NUMBER = 1519997.
DYNAMIC PRESSURE = 1023.16 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 27.000°
AVERAGED DATA OF 5 CYCLES

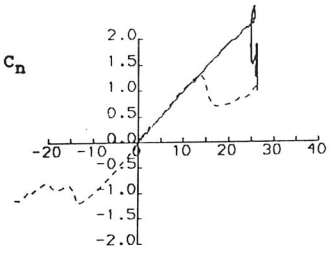
DATE OF TEST: 16/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 22.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.04009
LINEAR PITCH RATE = 345.00°S^{-1}

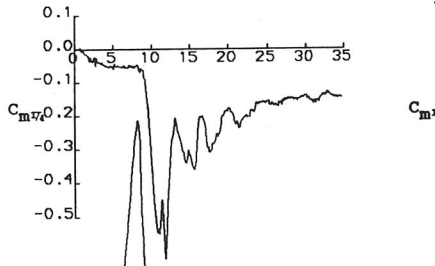


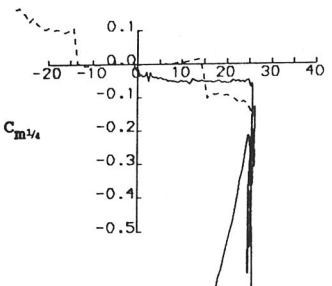


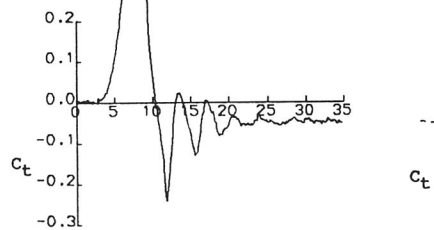


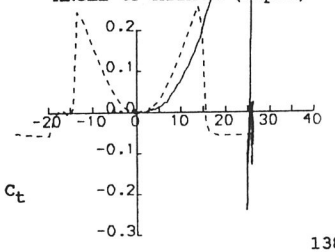








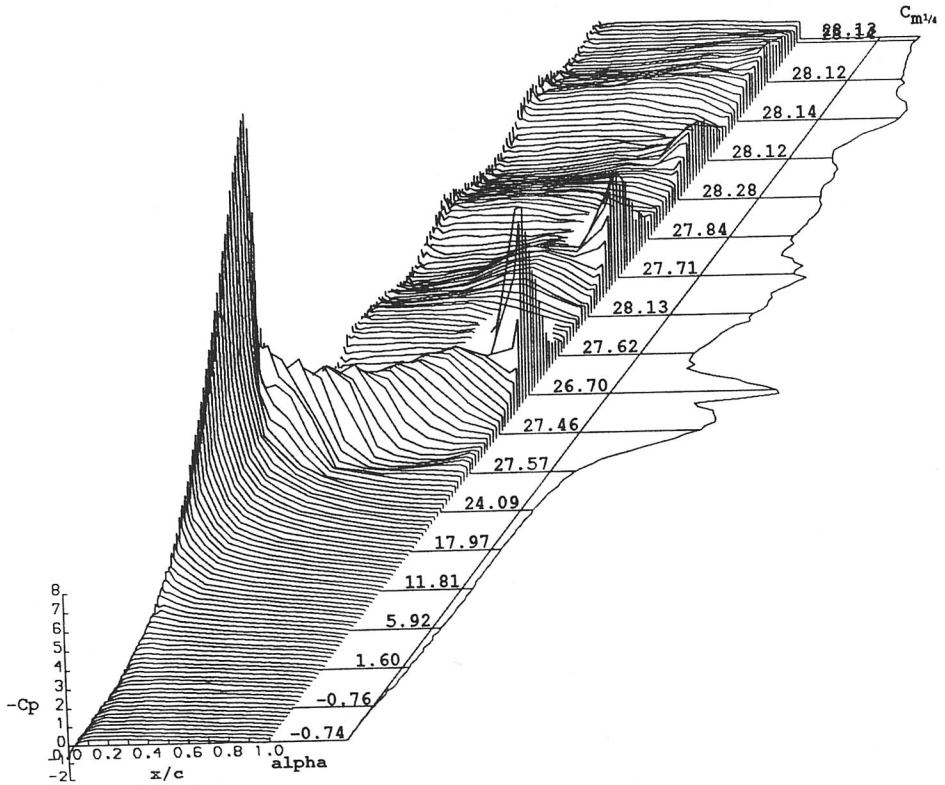


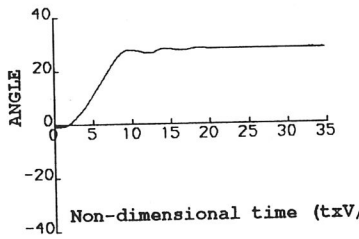


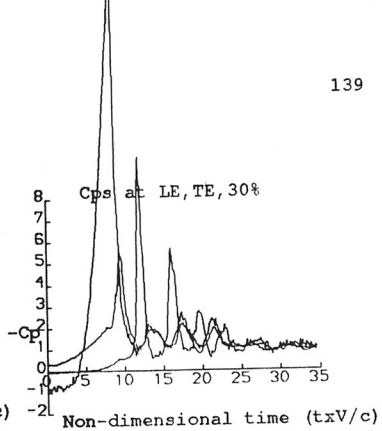
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

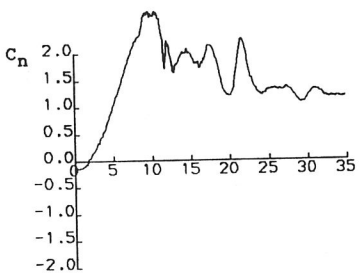
RUN REFERENCE NUMBER: 21391
REYNOLDS NUMBER = 1516702.
DYNAMIC PRESSURE = 1023.16 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 29.000°
AVERAGED DATA OF 5 CYCLES

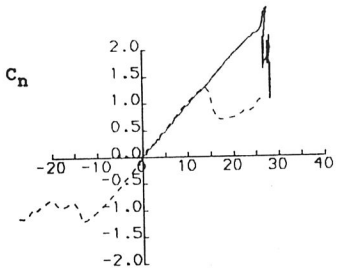
DATE OF TEST: 16/1/91
MACH NUMBER = 0.120
AIR TEMPERATURE = 22.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03790
LINEAR PITCH RATE = 326.43°S^{-1}

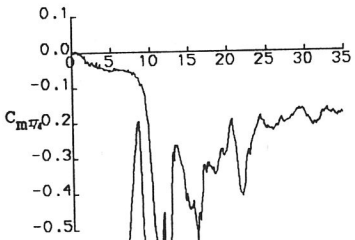


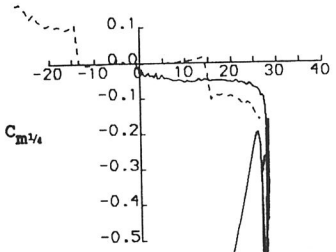


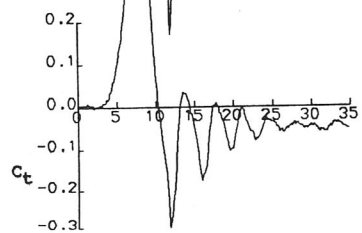


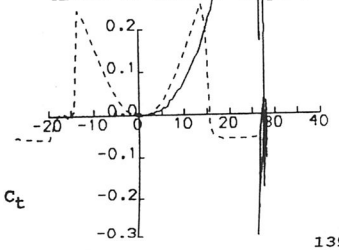








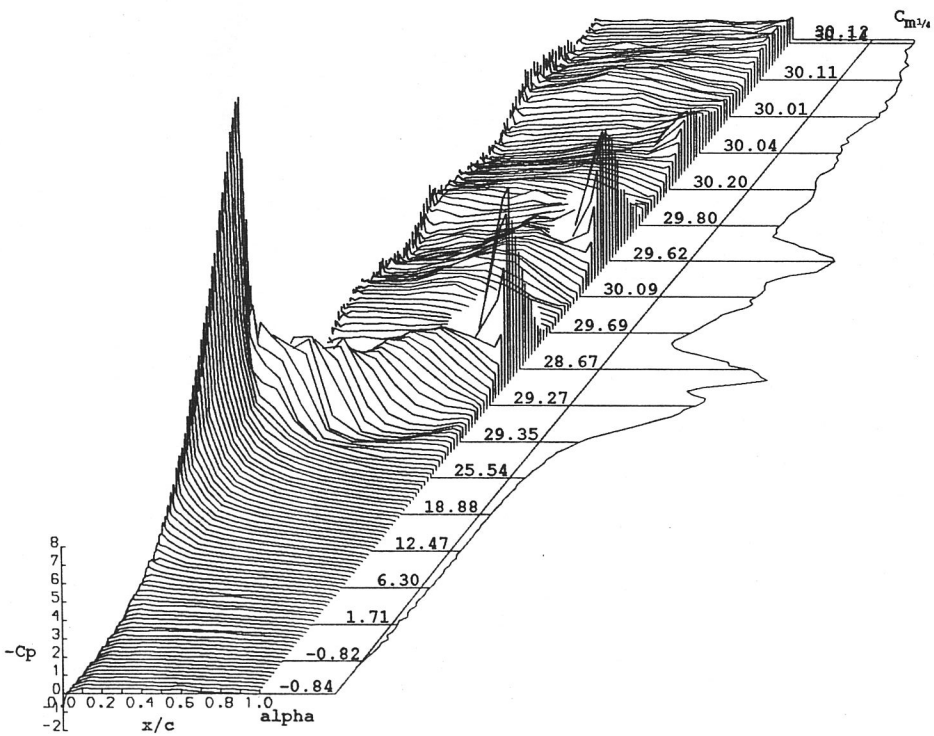


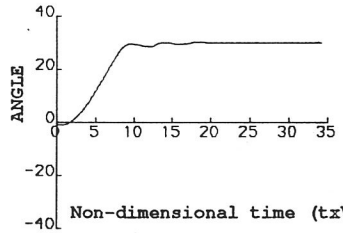


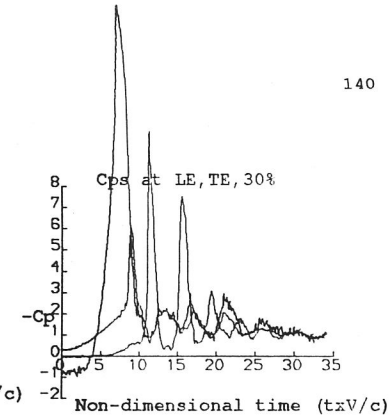
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

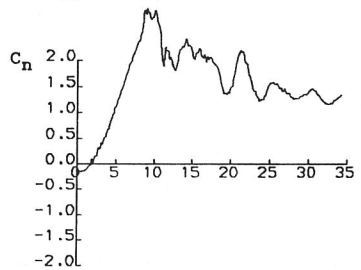
RUN REFERENCE NUMBER: 21401
REYNOLDS NUMBER = 1457978.
DYNAMIC PRESSURE = 977.74 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 31.000°
AVERAGED DATA OF 5 CYCLES

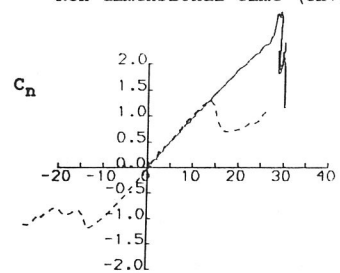
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.04162
LINEAR PITCH RATE = 352.68°S^{-1}

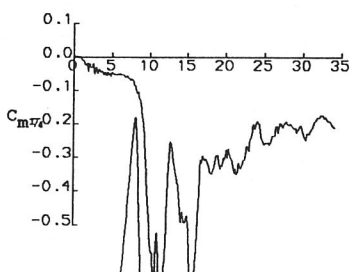


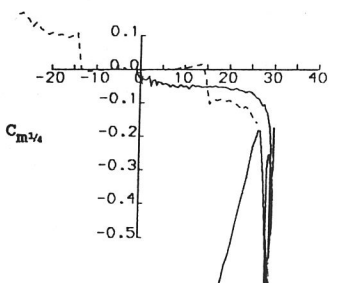


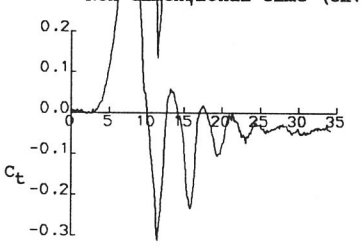


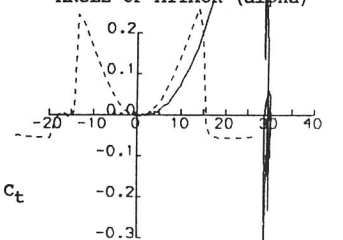








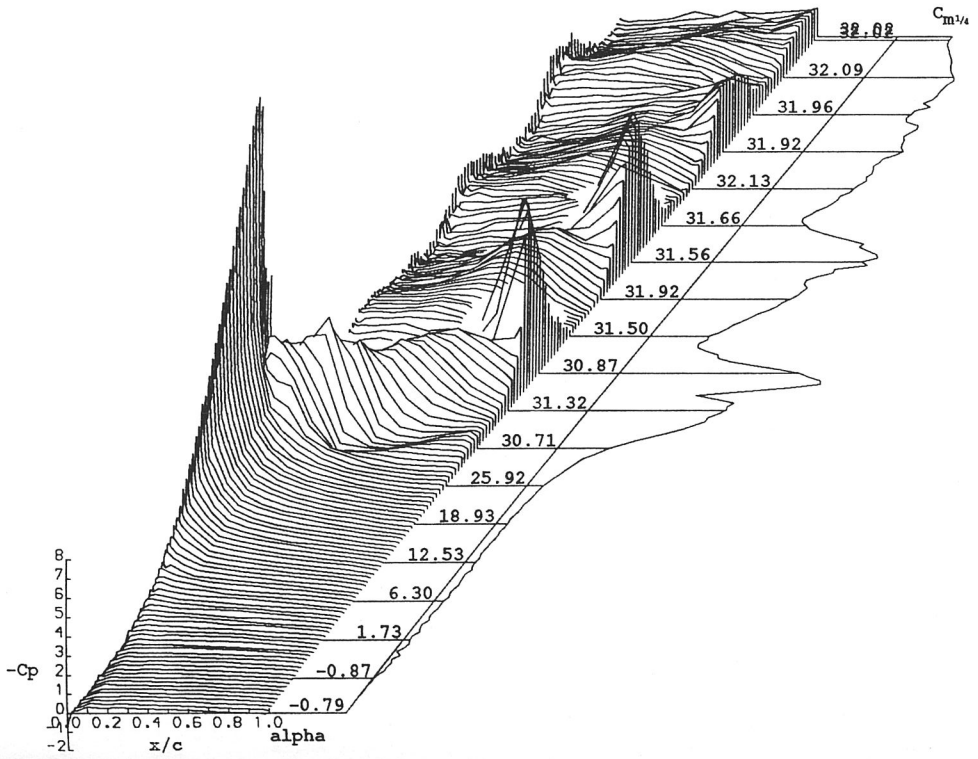


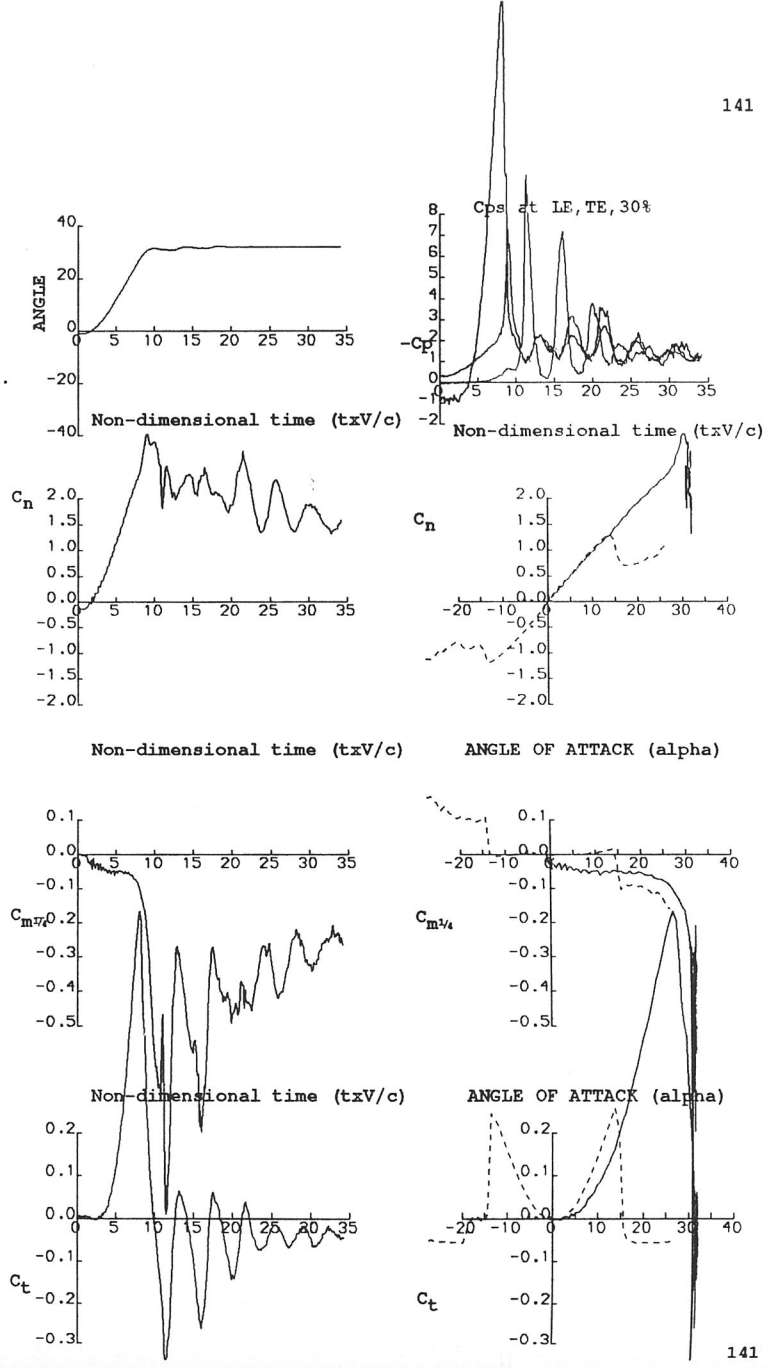


DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 21411
REYNOLDS NUMBER = 1454871.
DYNAMIC PRESSURE = 977.74 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 33.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 27.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.04196
LINEAR PITCH RATE = 355.93°S^{-1}

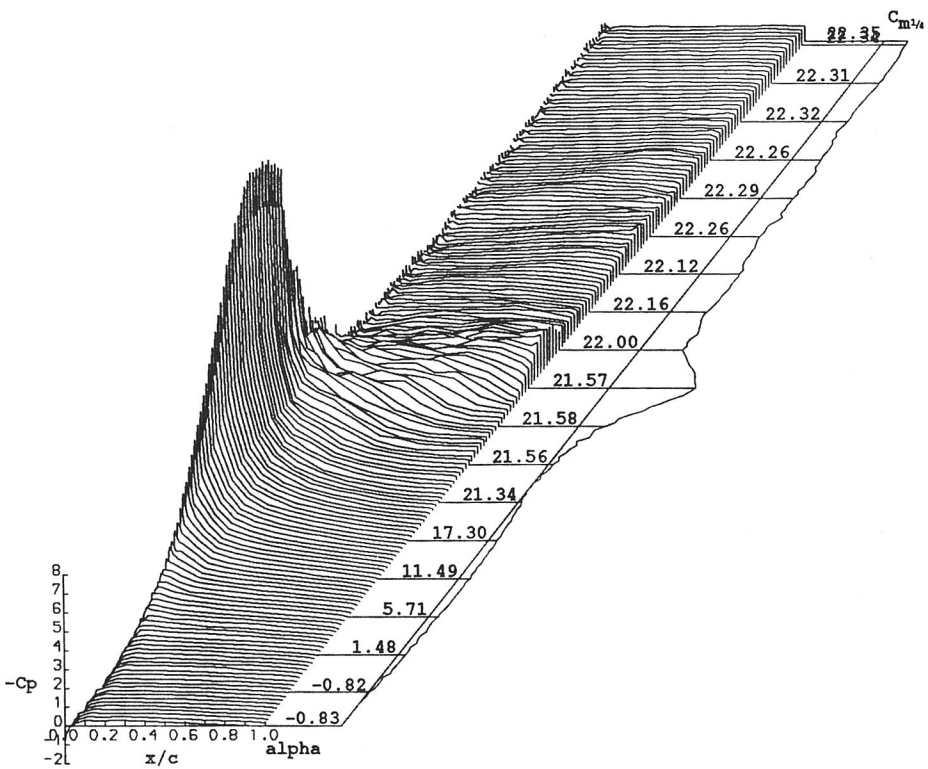


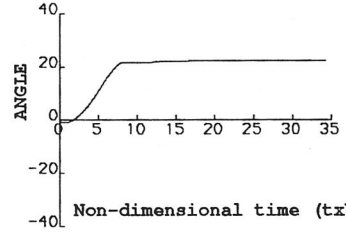


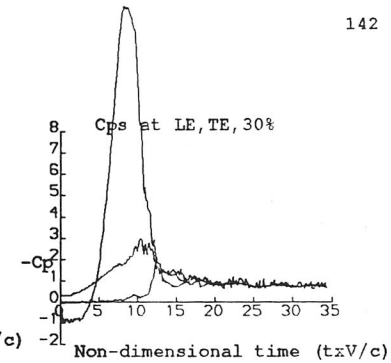
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

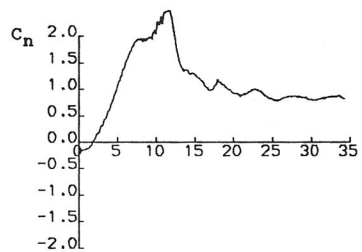
RUN REFERENCE NUMBER: 21421
REYNOLDS NUMBER = 1504079.
DYNAMIC PRESSURE = 999.24 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 23.000°
AVERAGED DATA OF 5 CYCLES

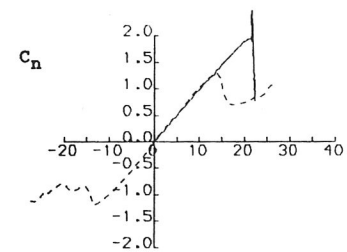
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 22.0°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03750
LINEAR PITCH RATE = 318.73°S^{-1}

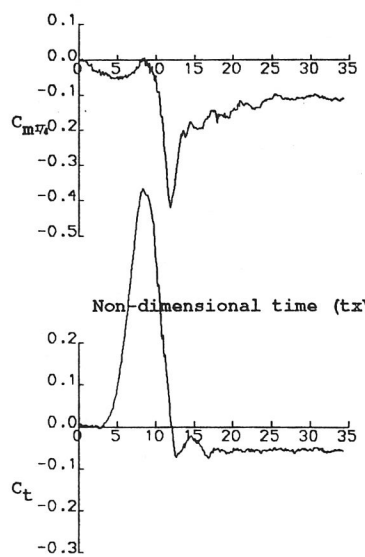


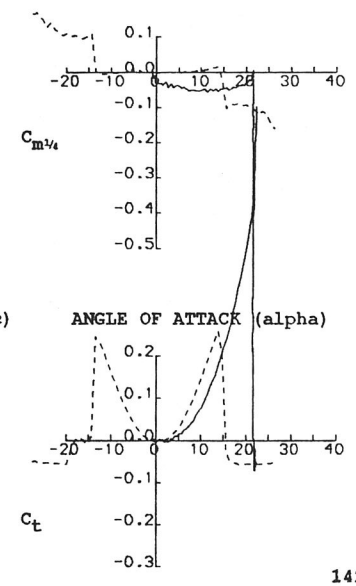








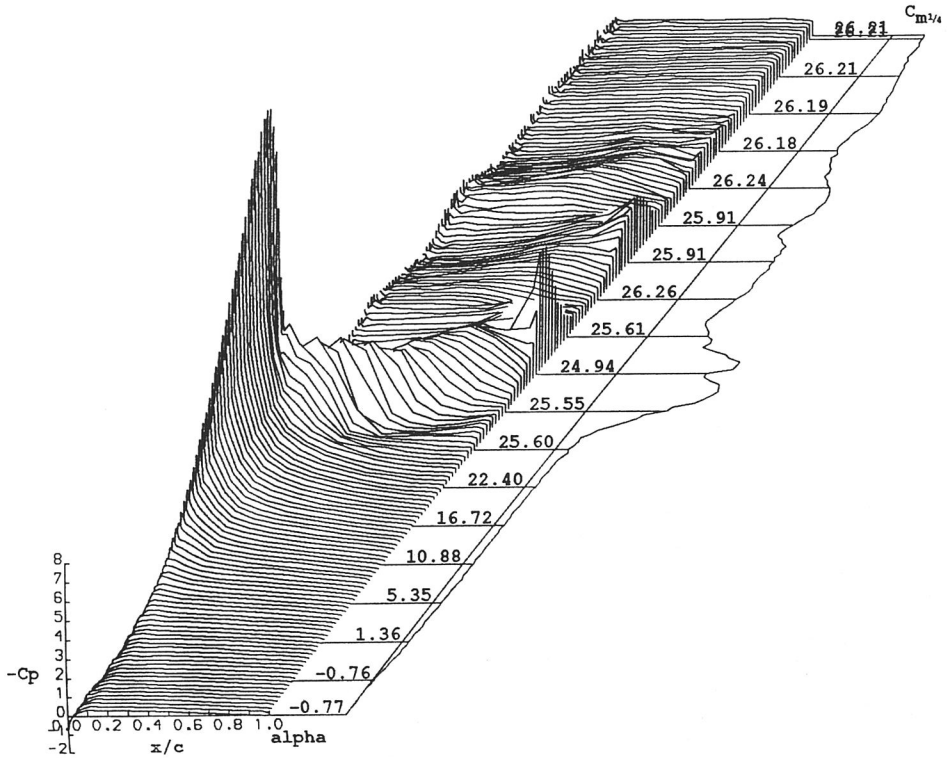


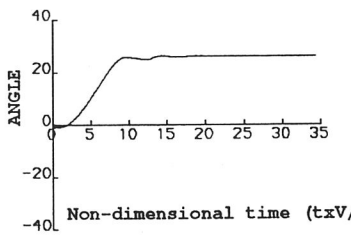


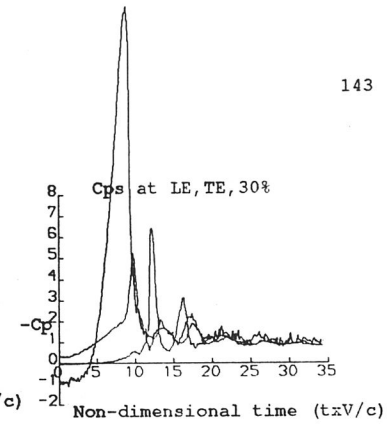
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

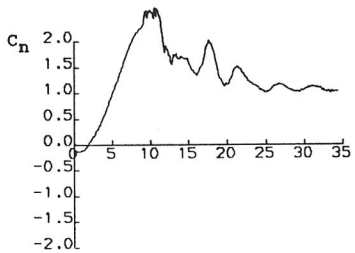
RUN REFERENCE NUMBER: 21431
REYNOLDS NUMBER = 1496914.
DYNAMIC PRESSURE = 999.24 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 27.000°
AVERAGED DATA OF 5 CYCLES

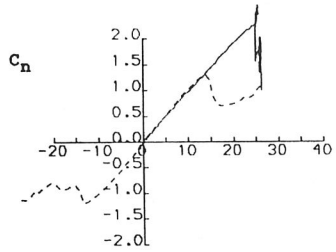
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.1°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03664
LINEAR PITCH RATE = 312.02°S^{-1}

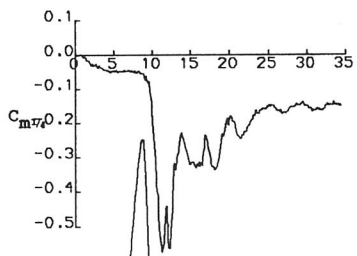


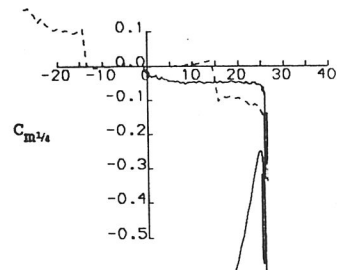


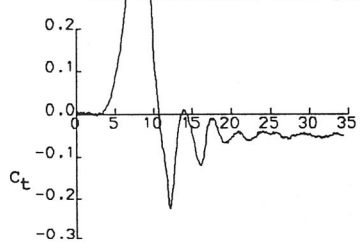


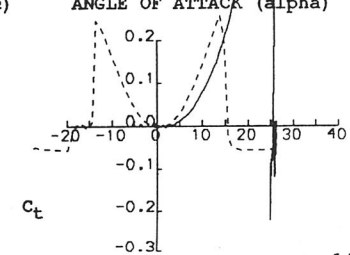








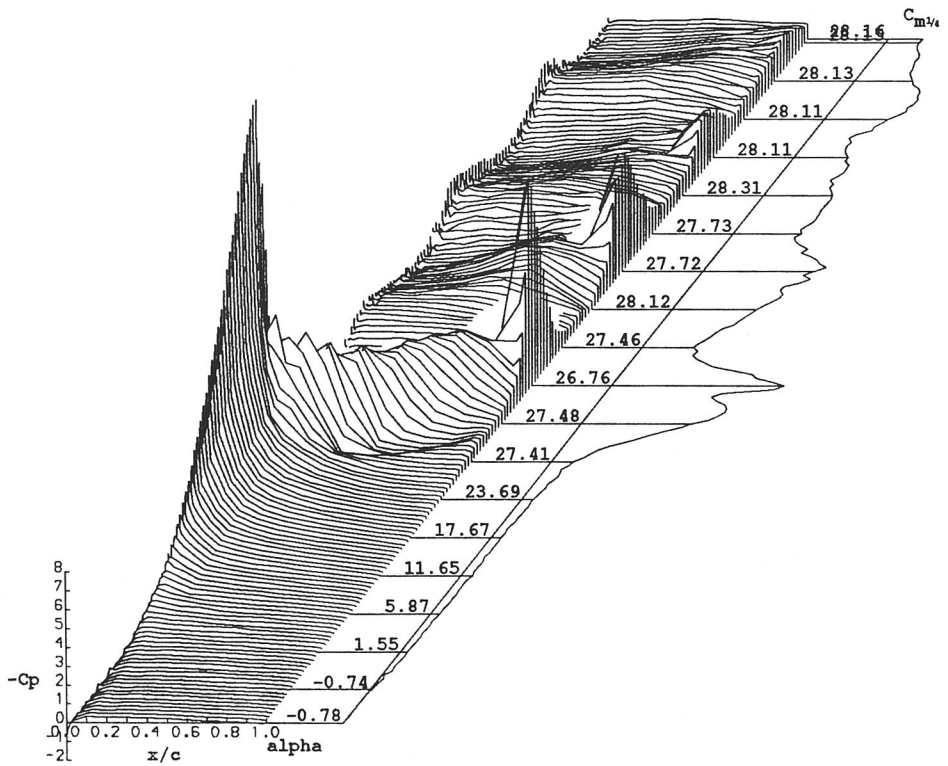


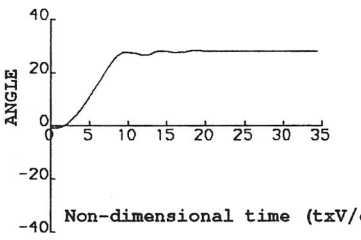


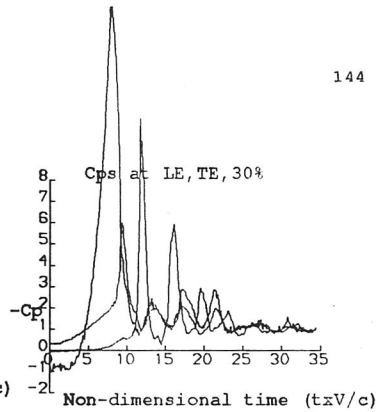
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

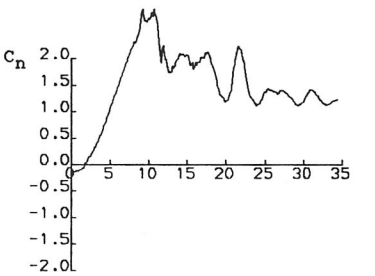
RUN REFERENCE NUMBER: 21441
REYNOLDS NUMBER = 1494972.
DYNAMIC PRESSURE = 999.24 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 29.000°
AVERAGED DATA OF 5 CYCLES

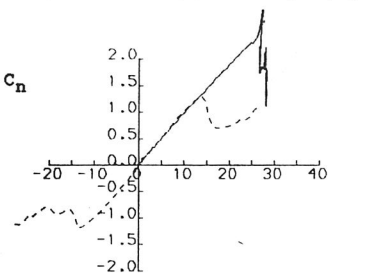
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.4°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03889
LINEAR PITCH RATE = 331.37°S^{-1}

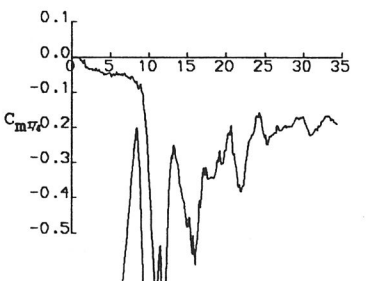


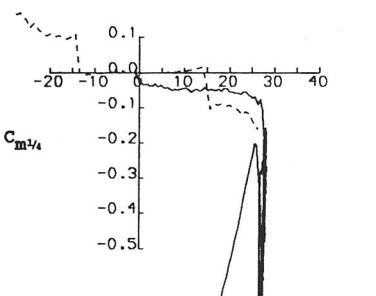


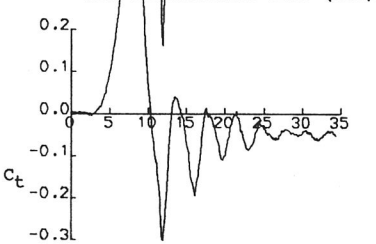


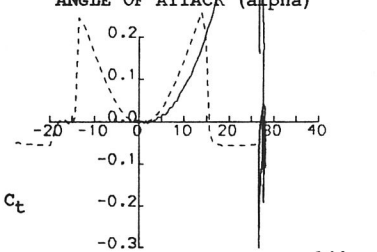








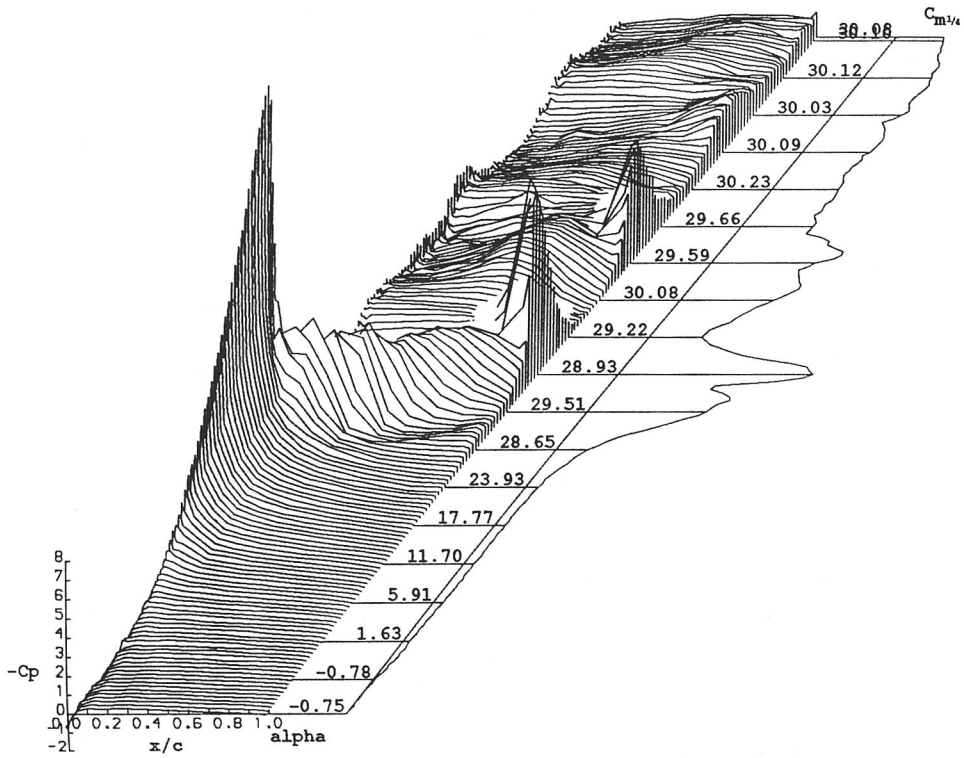


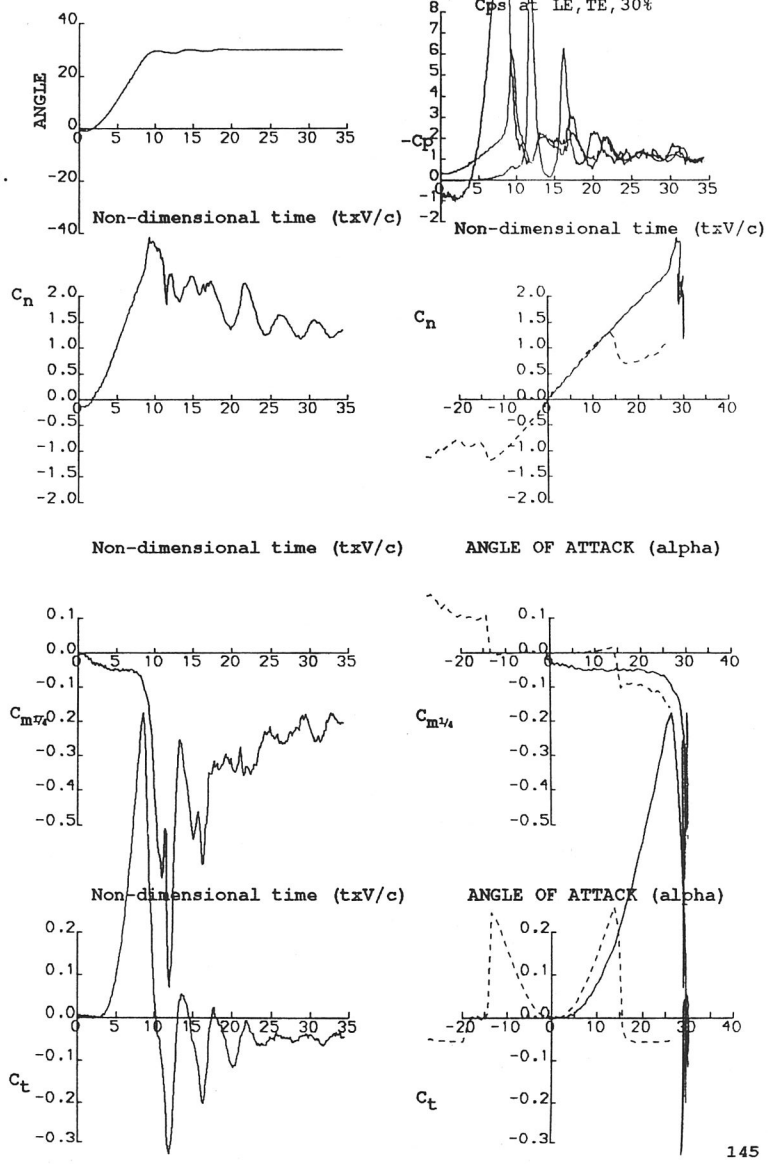


DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 21451
REYNOLDS NUMBER = 1492389.
DYNAMIC PRESSURE = 999.24 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 31.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03892
LINEAR PITCH RATE = 331.86°S^{-1}

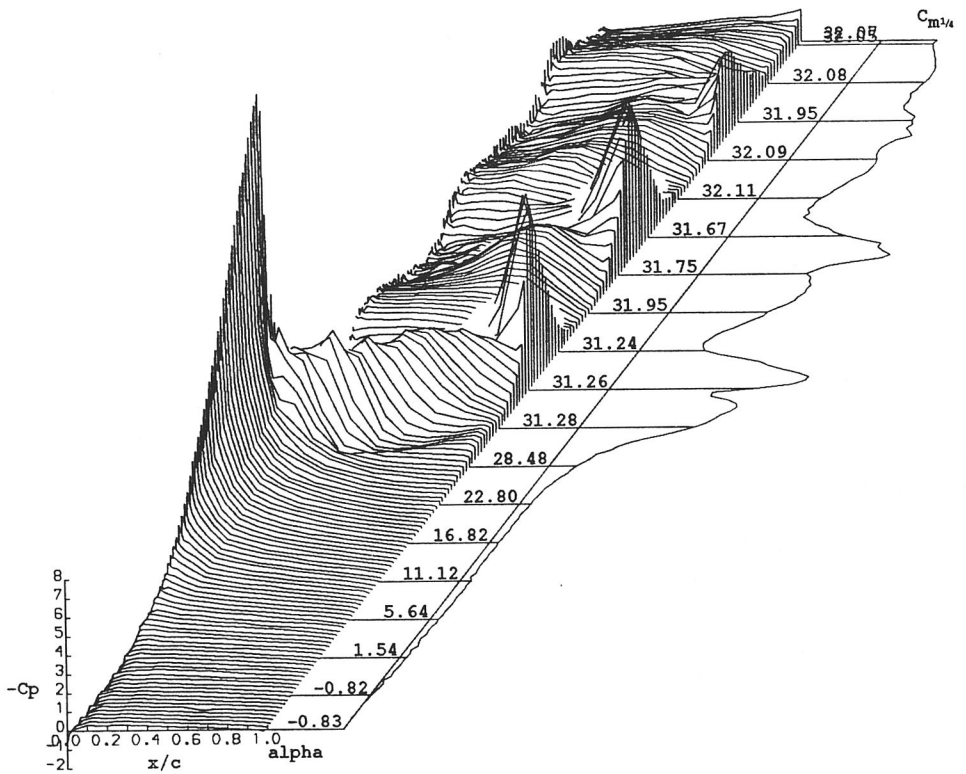


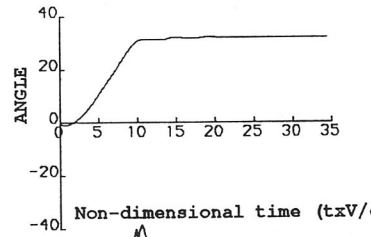


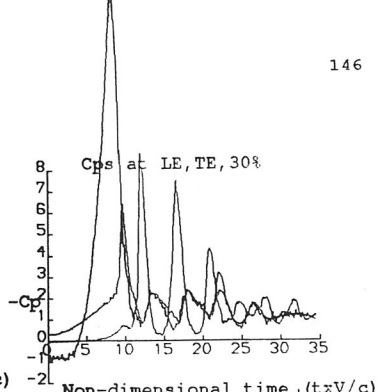
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

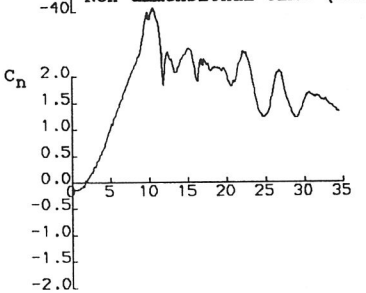
RUN REFERENCE NUMBER: 21461
REYNOLDS NUMBER = 1490458.
DYNAMIC PRESSURE = 999.24 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 33.000°
AVERAGED DATA OF 5 CYCLES

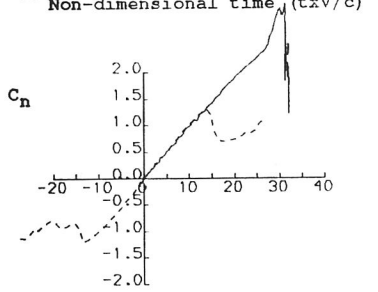
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.1°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03689
LINEAR PITCH RATE = 314.65°S^{-1}

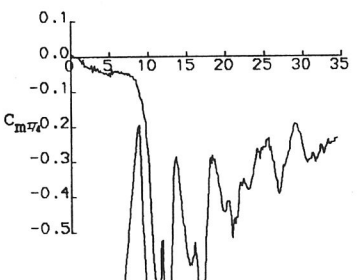


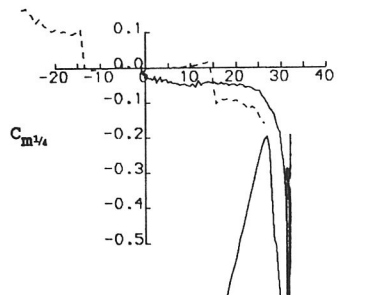


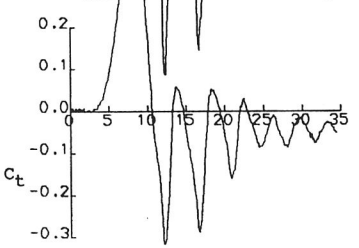


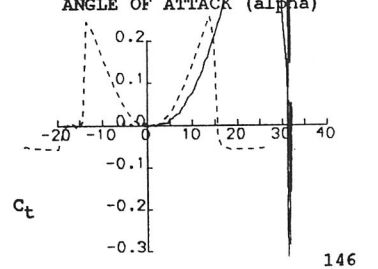








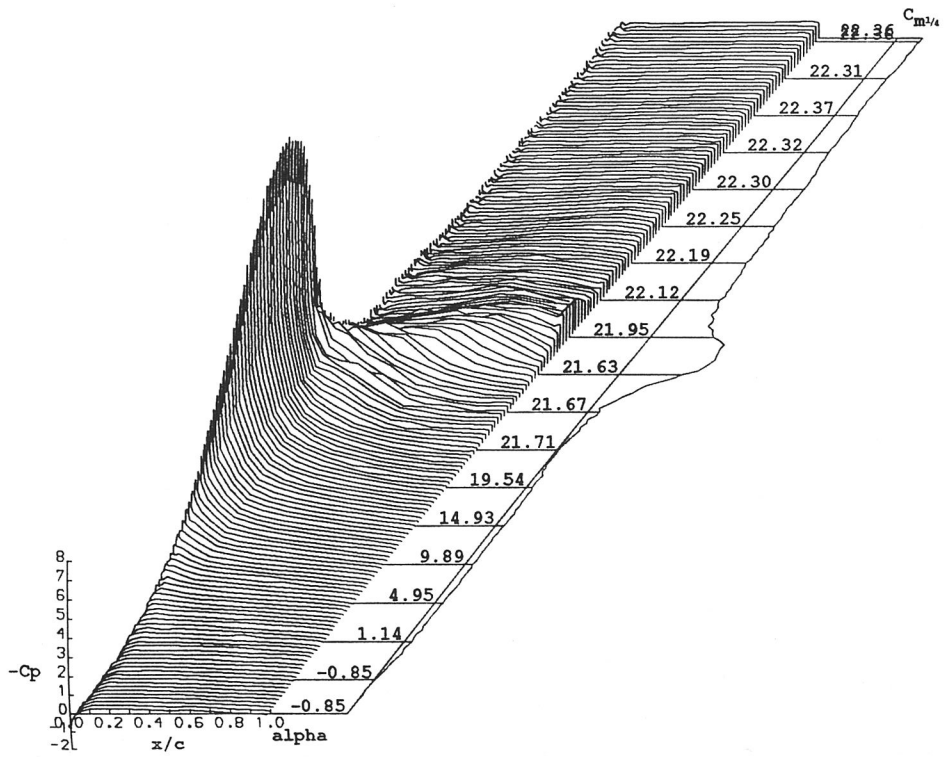


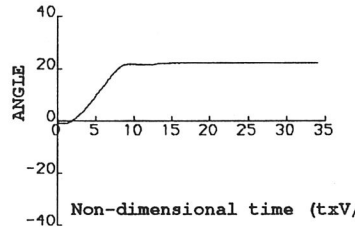


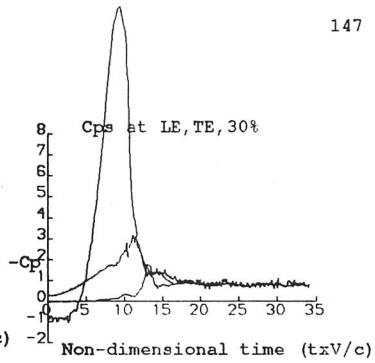
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

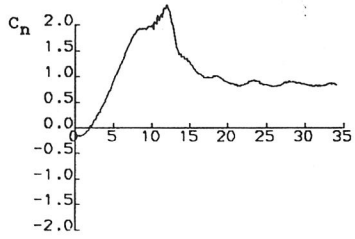
RUN REFERENCE NUMBER: 21471
REYNOLDS NUMBER = 1488239.
DYNAMIC PRESSURE = 984.27 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 23.000°
AVERAGED DATA OF 5 CYCLES

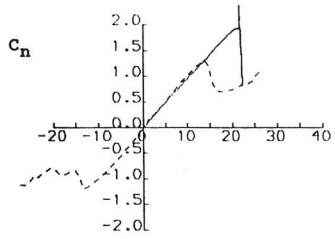
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 22.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03315
LINEAR PITCH RATE = 279.98°S^{-1}

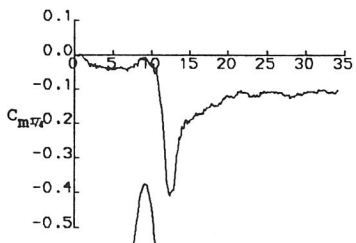


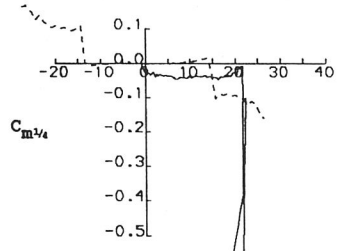


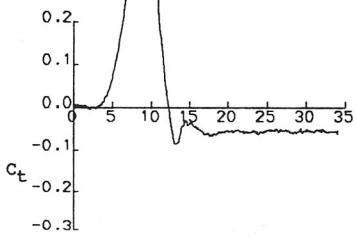


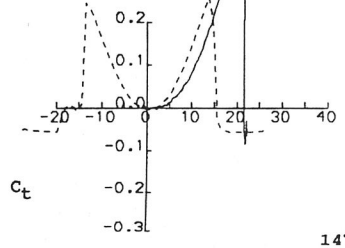






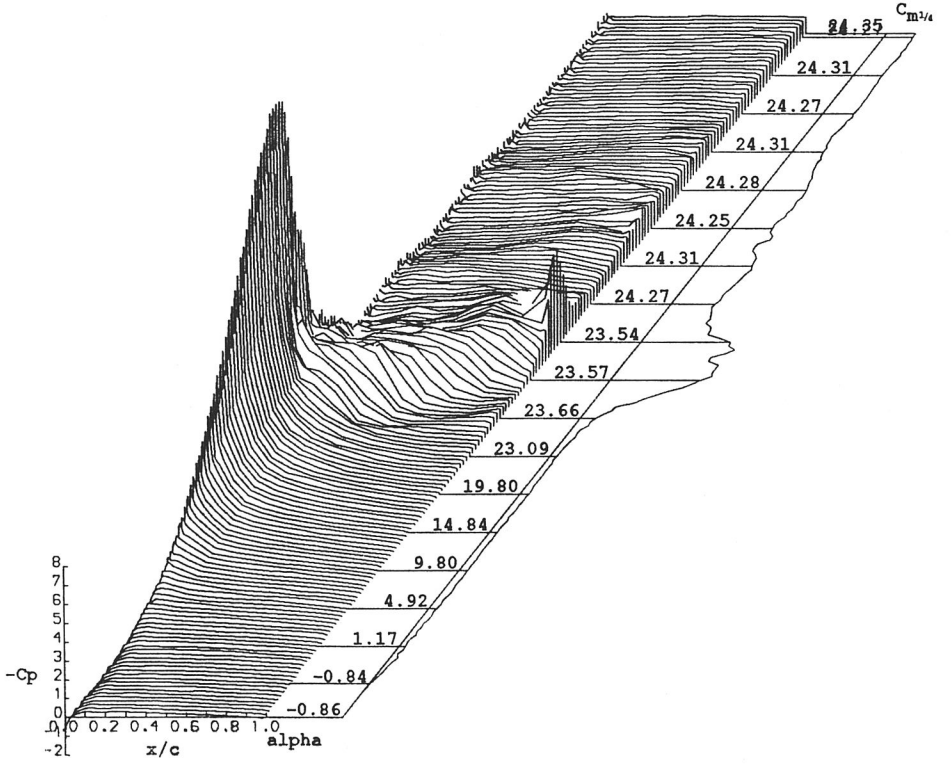


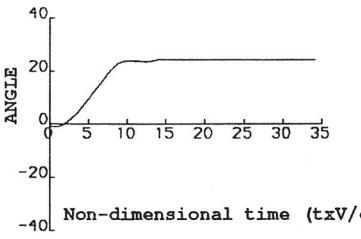


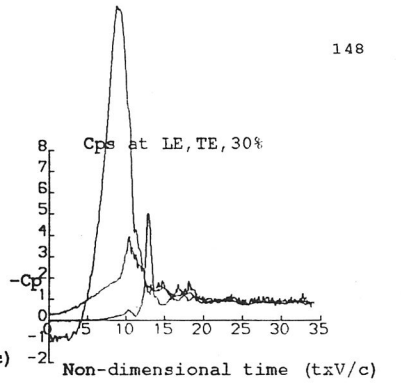


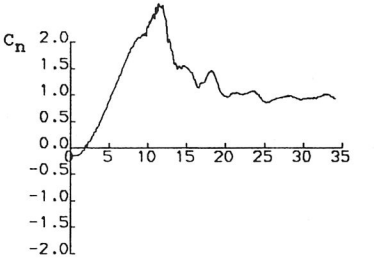
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

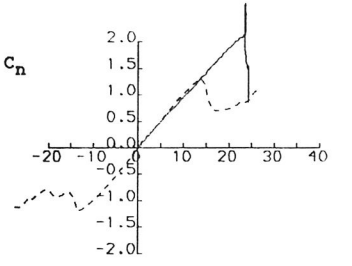
RUN REFERENCE NUMBER: 21481
DATE OF TEST: 16/1/91
REYNOLDS NUMBER = 1484376.
MACH NUMBER = 0.118
DYNAMIC PRESSURE = 984.27 Nm^{-2}
AIR TEMPERATURE = 23.3°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 550.05 Hz.
MOTION TYPE: RAMP UP
REDUCED PITCH RATE = 0.03325
START ANGLE = -1.00°
LINEAR PITCH RATE = 281.14°S^{-1}
RAMP ARC = 25.000°
AVERAGED DATA OF 5 CYCLES

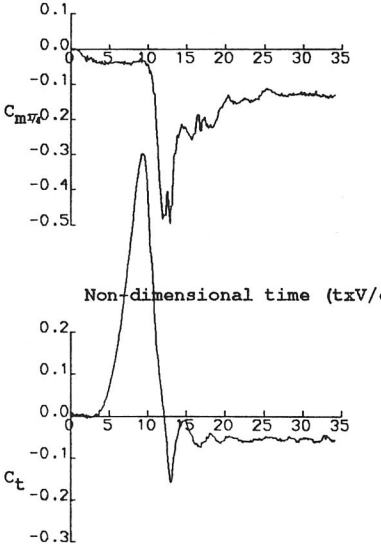


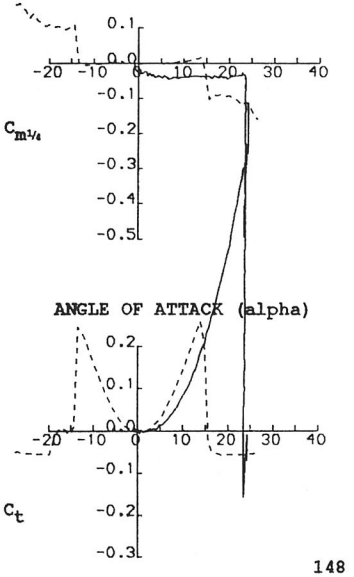








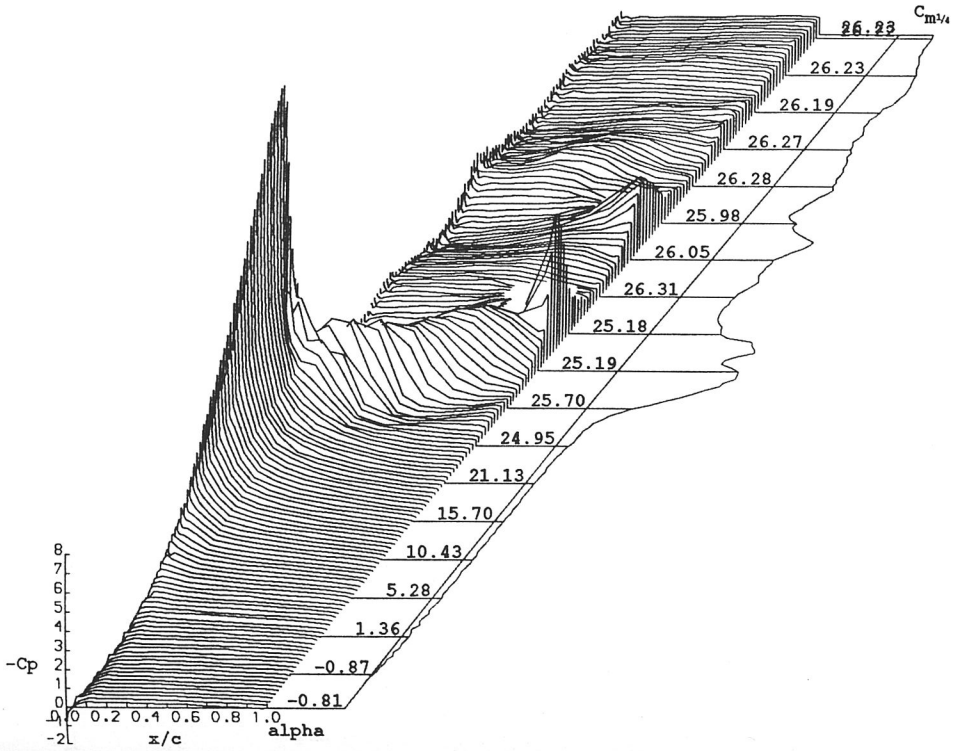


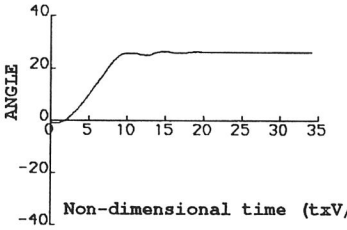


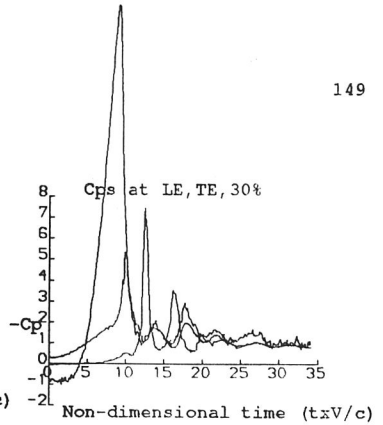
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

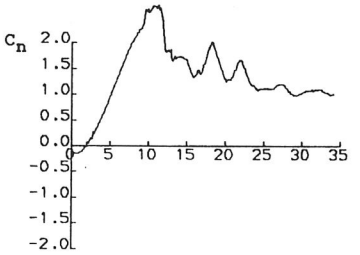
RUN REFERENCE NUMBER: 21491
REYNOLDS NUMBER = 1481170.
DYNAMIC PRESSURE = 984.27 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 27.000°
AVERAGED DATA OF 5 CYCLES

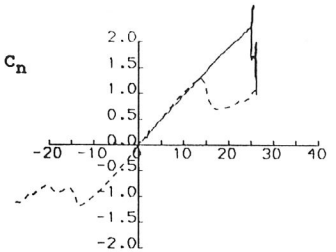
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03458
LINEAR PITCH RATE = 292.58°S^{-1}

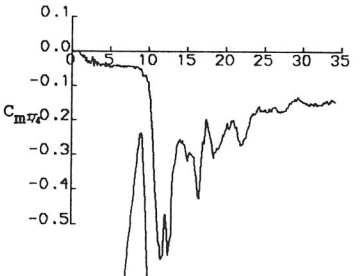


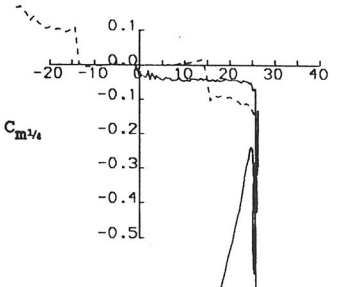


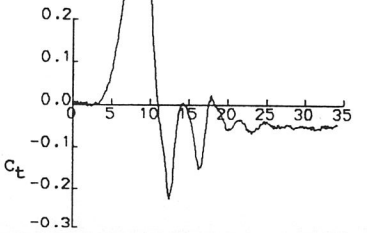


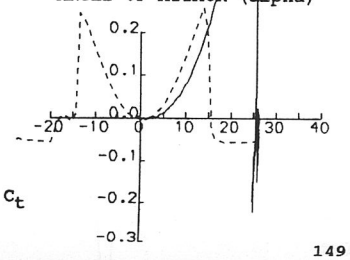








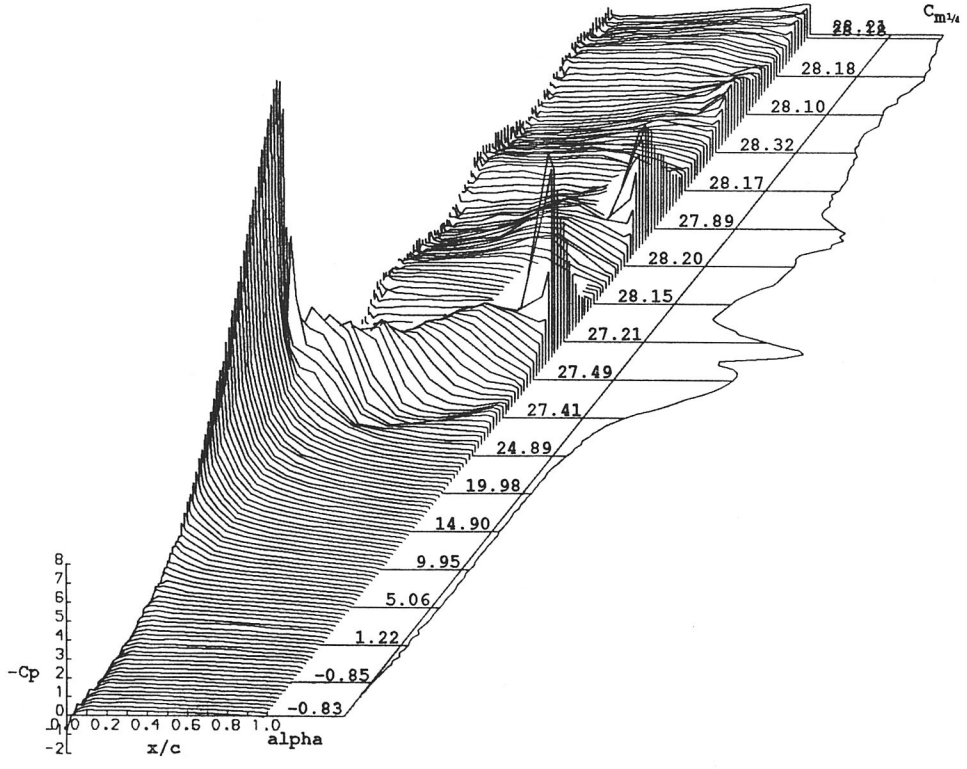


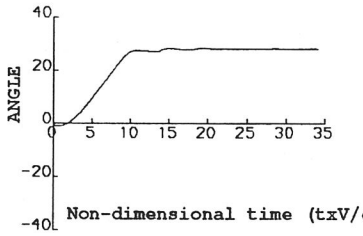


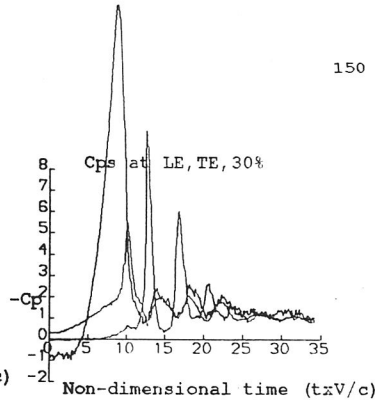
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

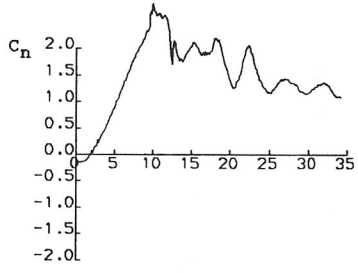
RUN REFERENCE NUMBER: 21501
REYNOLDS NUMBER = 1479891.
DYNAMIC PRESSURE = 984.27 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 29.000°
AVERAGED DATA OF 5 CYCLES

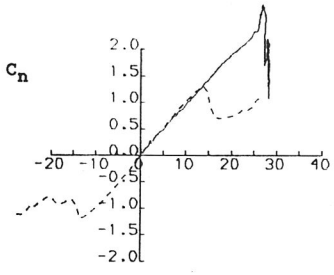
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.0°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03276
LINEAR PITCH RATE = 277.28°S^{-1}

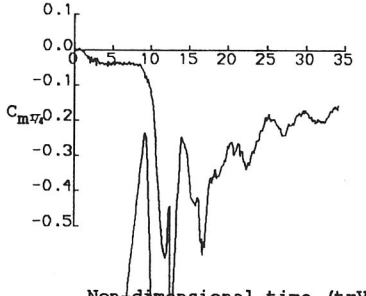


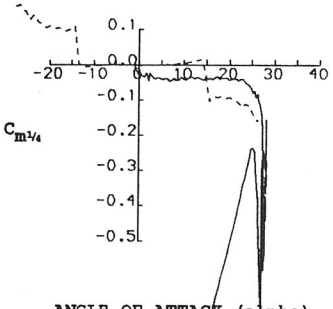


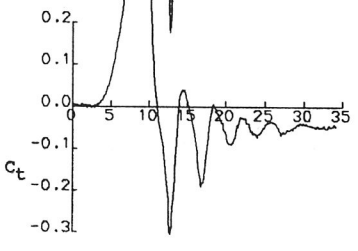


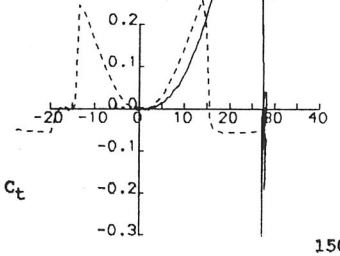








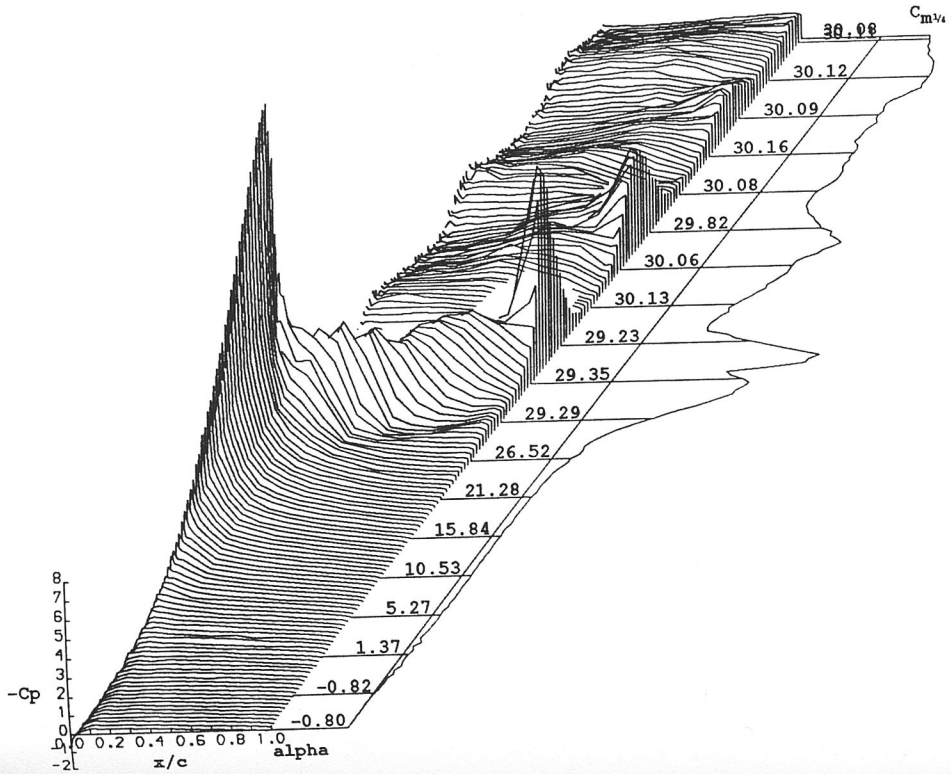


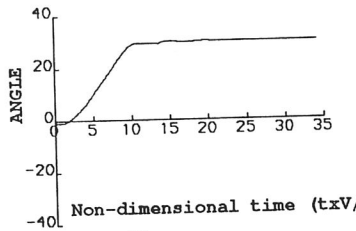


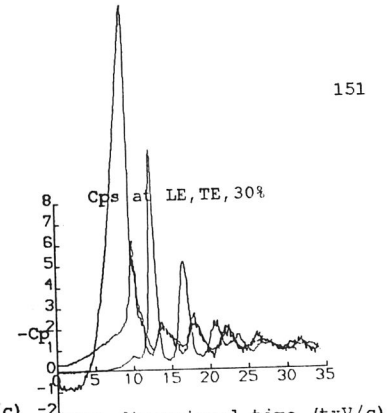
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

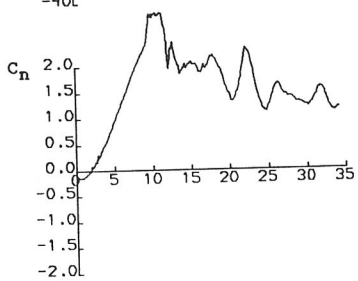
RUN REFERENCE NUMBER: 21511
REYNOLDS NUMBER = 1476704.
DYNAMIC PRESSURE = 984.27 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 31.000°
AVERAGED DATA OF 5 CYCLES

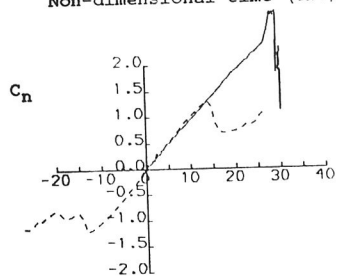
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03527
LINEAR PITCH RATE = 298.78°S^{-1}

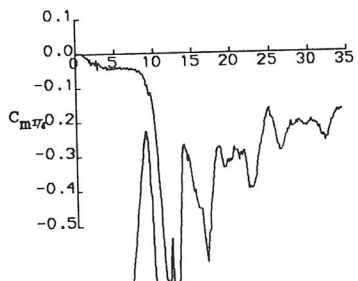


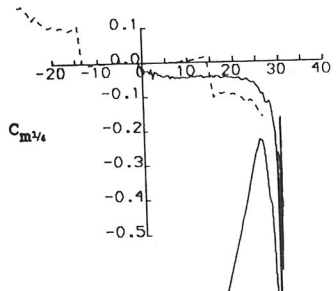


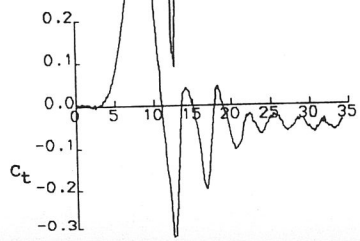


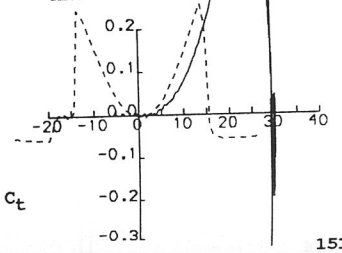








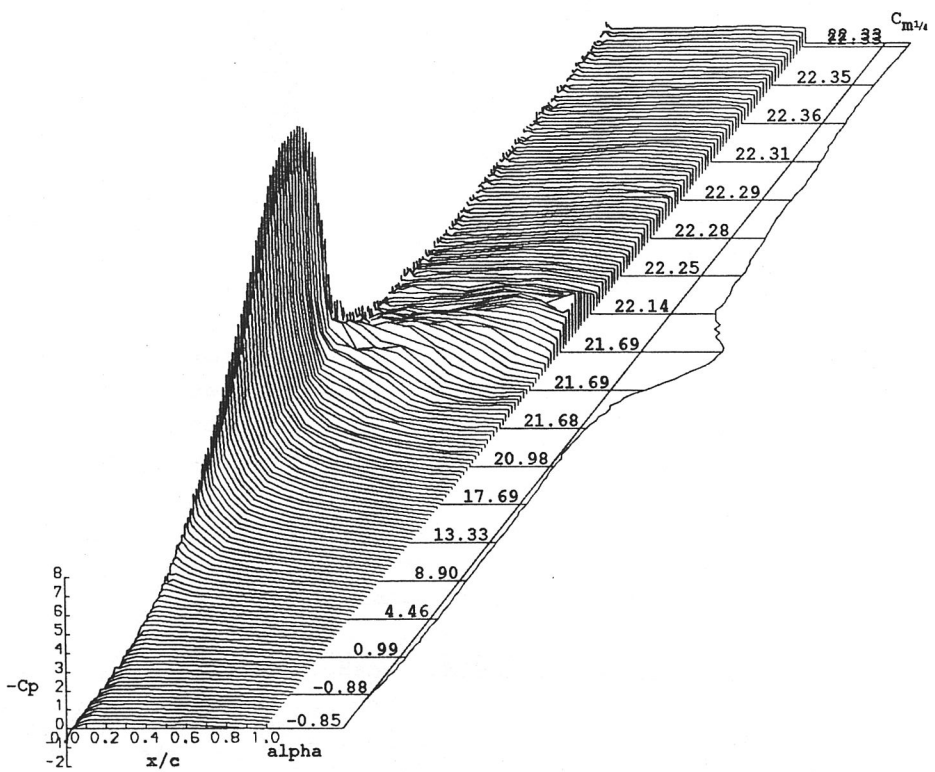


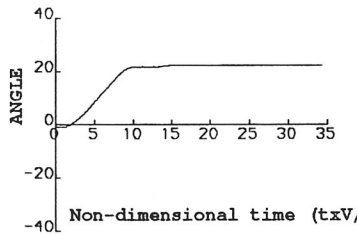


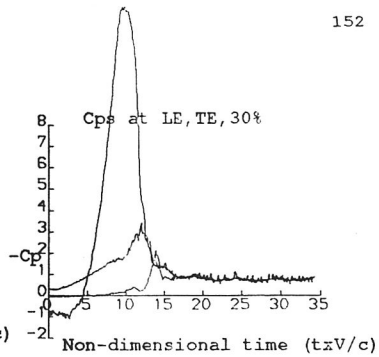
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

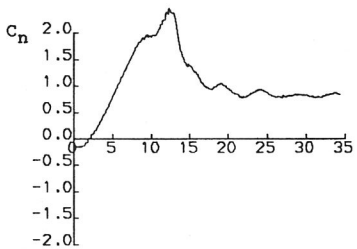
RUN REFERENCE NUMBER: 21521
REYNOLDS NUMBER = 1486625.
DYNAMIC PRESSURE = 993.25 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 23.000°
AVERAGED DATA OF 5 CYCLES

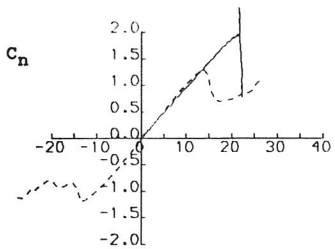
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.0°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02930
LINEAR PITCH RATE = 249.13°S^{-1}

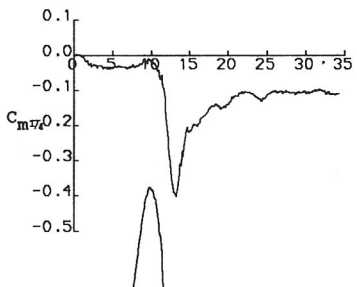


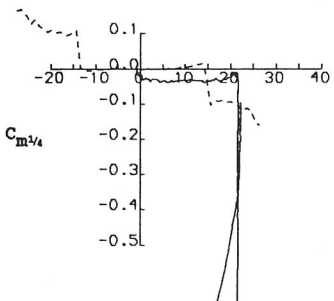


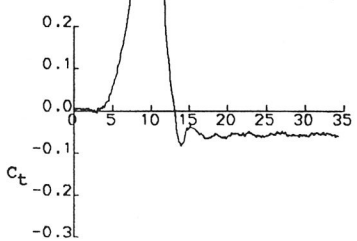


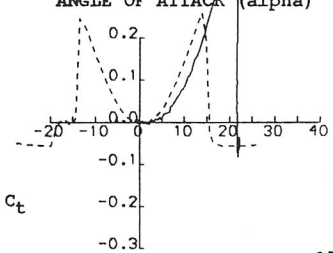






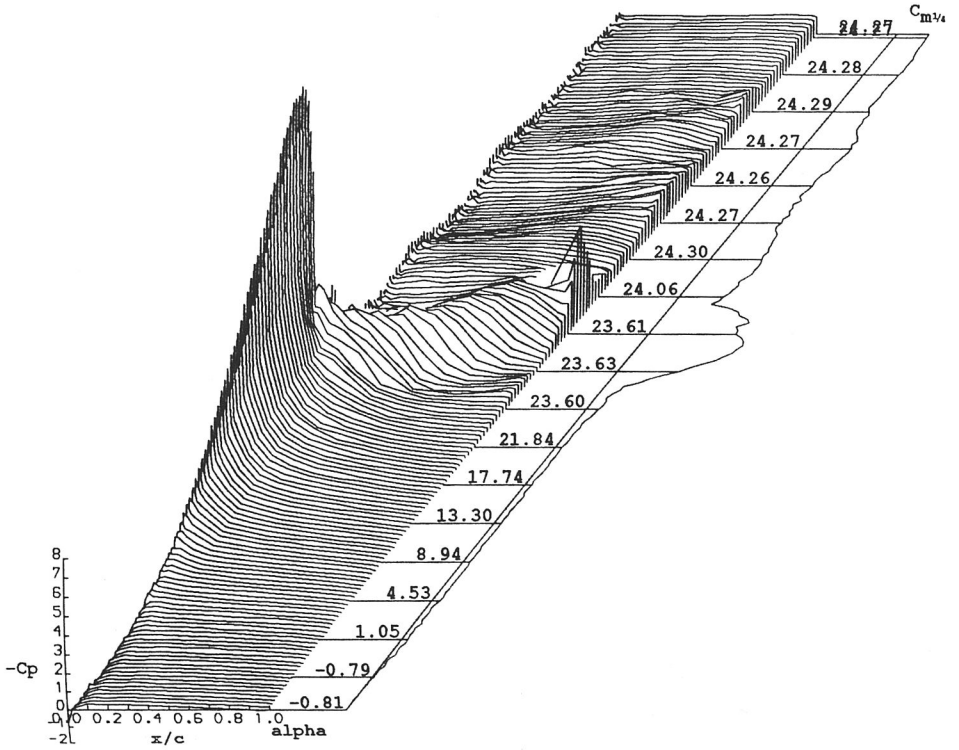


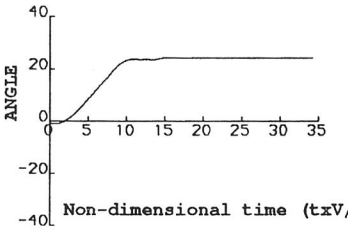


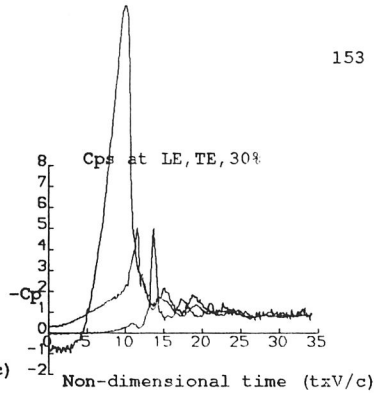


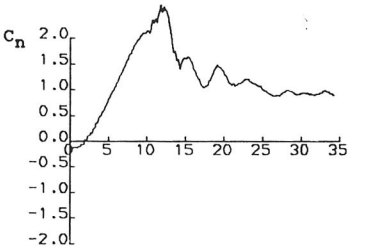
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

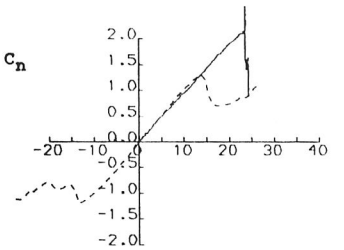
RUN REFERENCE NUMBER: 21531
DATE OF TEST: 16/1/91
REYNOLDS NUMBER = 1484703.
MACH NUMBER = 0.118
DYNAMIC PRESSURE = 993.25 Nm^{-2}
AIR TEMPERATURE = 24.3°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 550.05 Hz.
MOTION TYPE: RAMP UP
REDUCED PITCH RATE = 0.02809
START ANGLE = -1.00°
LINEAR PITCH RATE = 239.01°S^{-1}
RAMP ARC = 25.000°
AVERAGED DATA OF 5 CYCLES

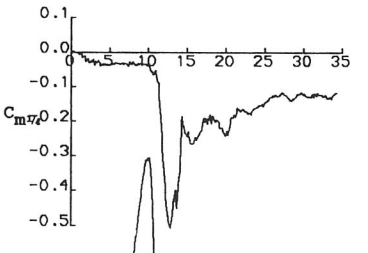


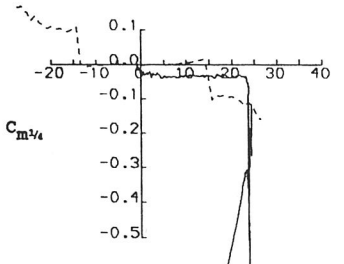


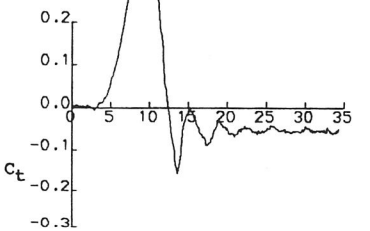


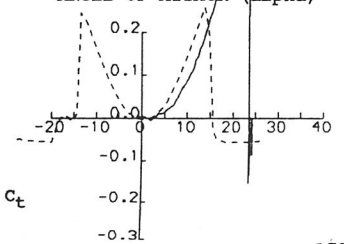








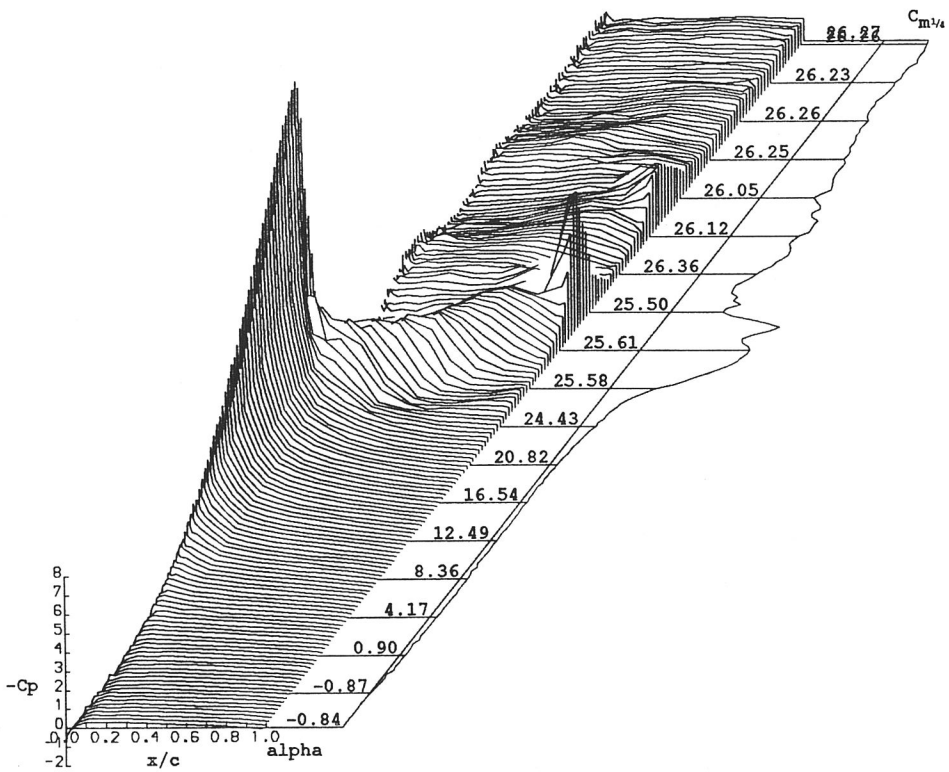


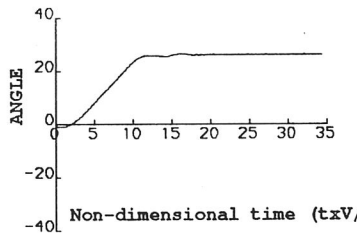


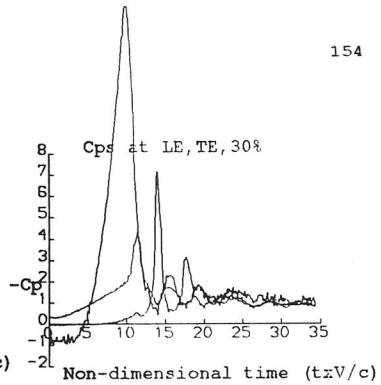
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

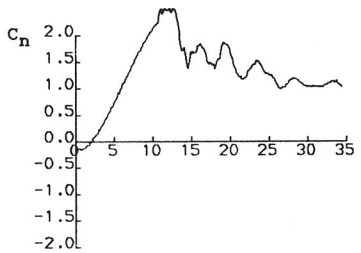
RUN REFERENCE NUMBER: 21541
REYNOLDS NUMBER = 1482146.
DYNAMIC PRESSURE = 993.25 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 27.000°
AVERAGED DATA OF 5 CYCLES

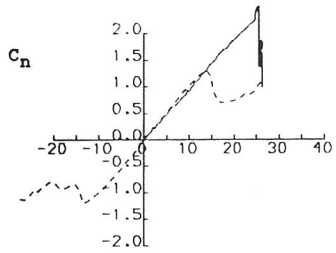
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02663
LINEAR PITCH RATE = 226.66°S^{-1}

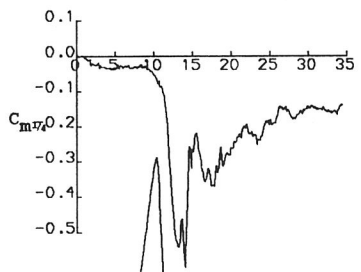


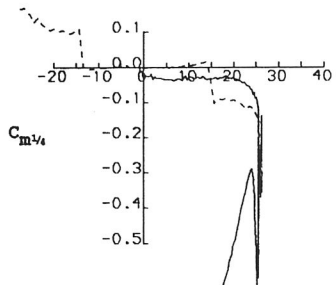


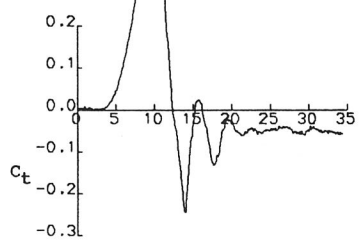


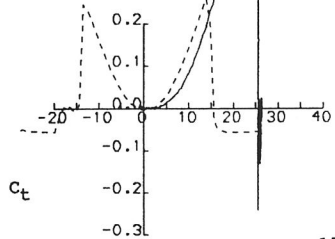








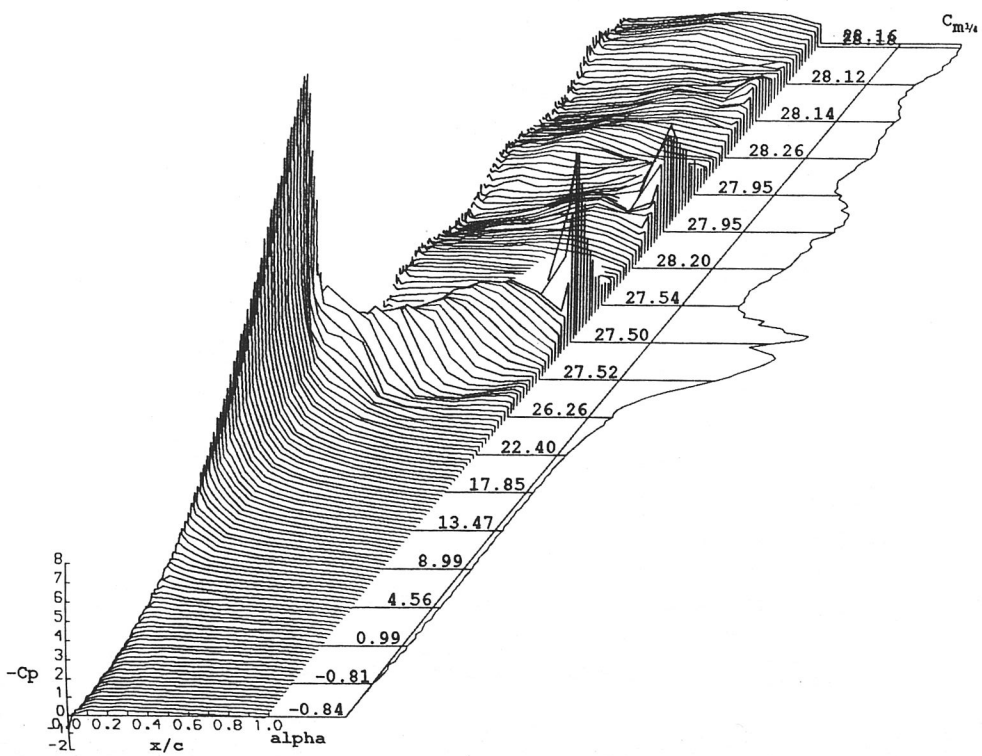


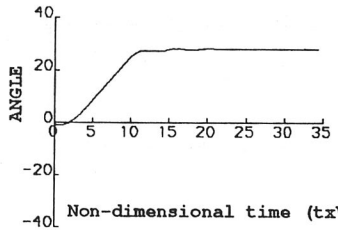


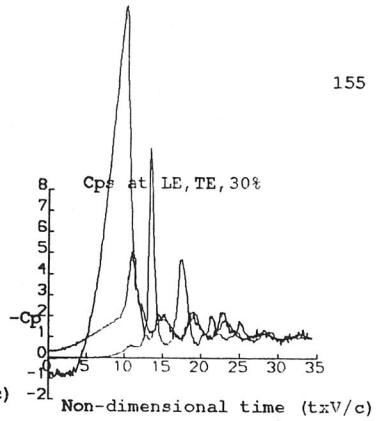
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

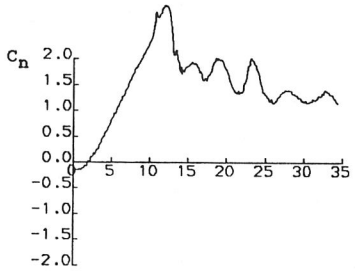
RUN REFERENCE NUMBER: 21551
REYNOLDS NUMBER = 1480872.
DYNAMIC PRESSURE = 993.25 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 29.000°
AVERAGED DATA OF 5 CYCLES

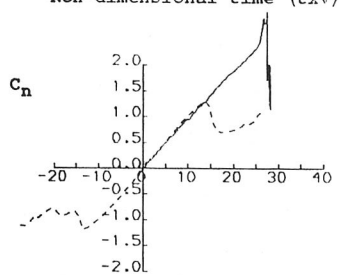
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02919
LINEAR PITCH RATE = 248.61°S^{-1}

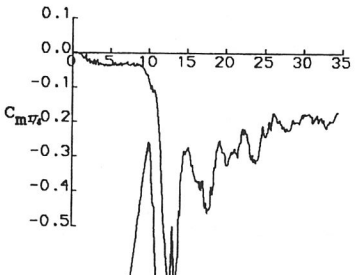


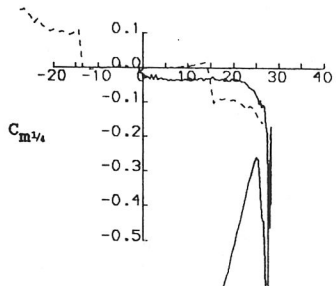


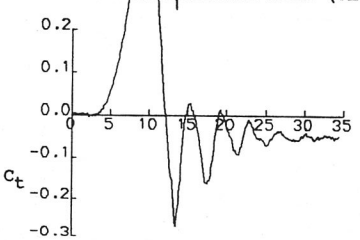


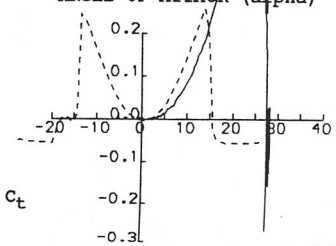








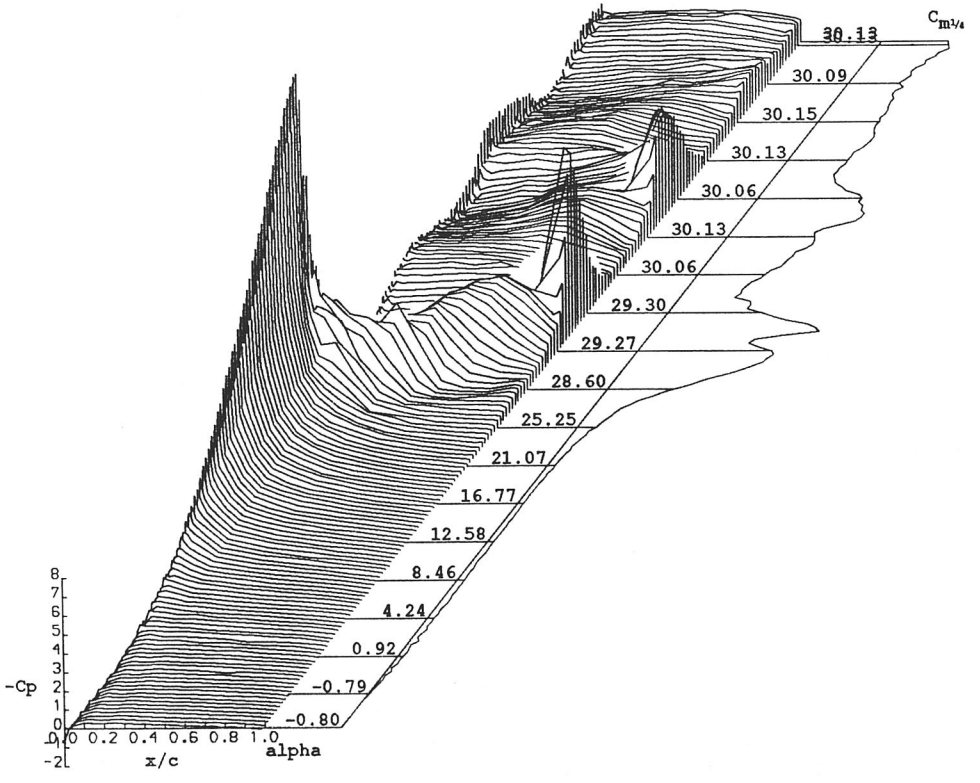


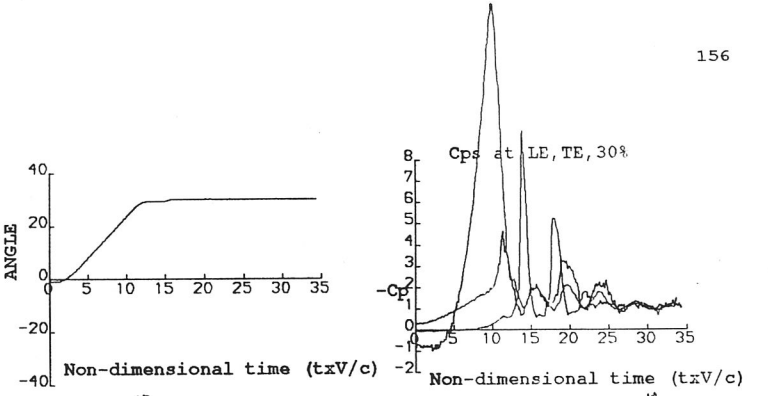


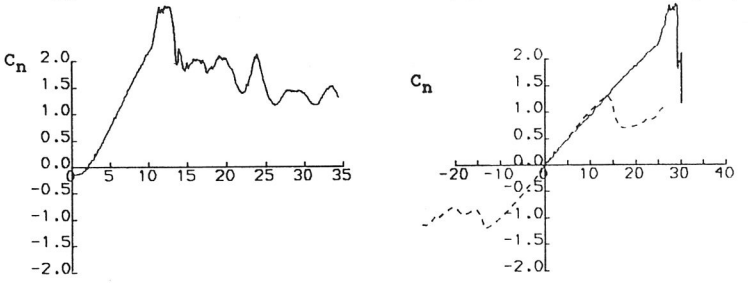
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

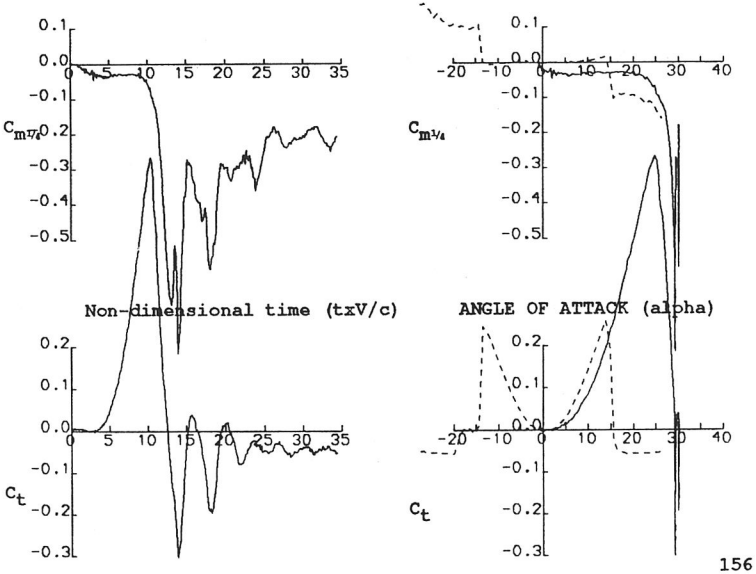
RUN REFERENCE NUMBER: 21561
REYNOLDS NUMBER = 1478963.
DYNAMIC PRESSURE = 993.25 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 31.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02676
LINEAR PITCH RATE = 228.01°S^{-1}





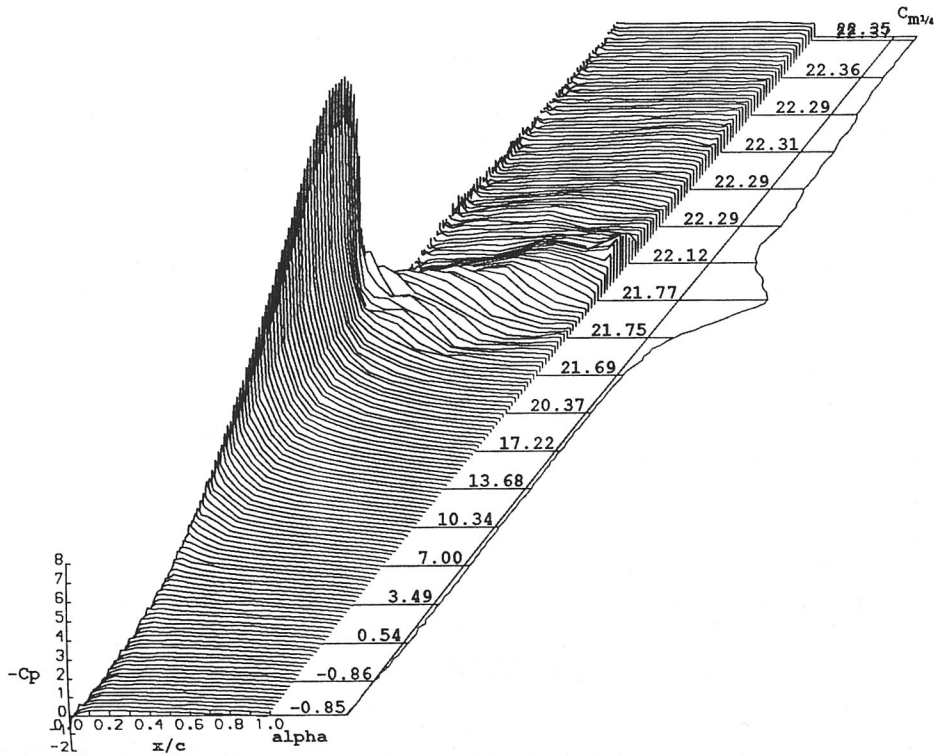


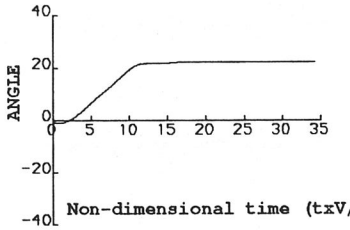


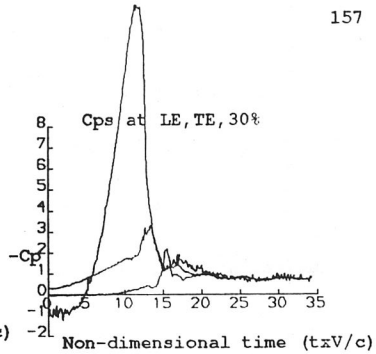
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

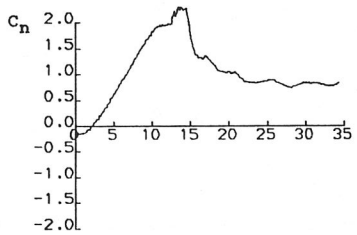
RUN REFERENCE NUMBER: 21571
REYNOLDS NUMBER = 1482859.
DYNAMIC PRESSURE = 992.49 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 23.000°
AVERAGED DATA OF 5 CYCLES

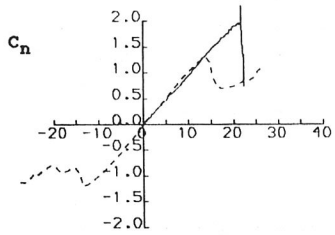
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02188
LINEAR PITCH RATE = 186.09°S^{-1}

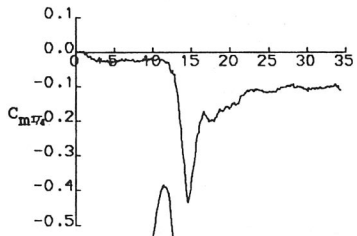


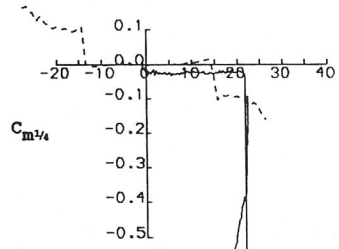


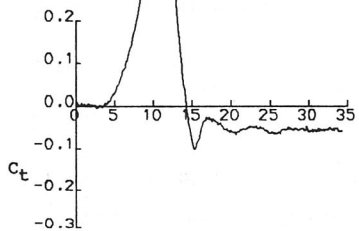


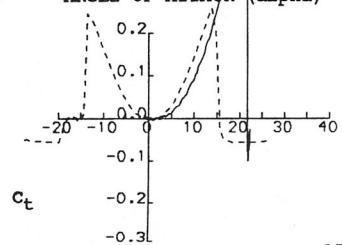








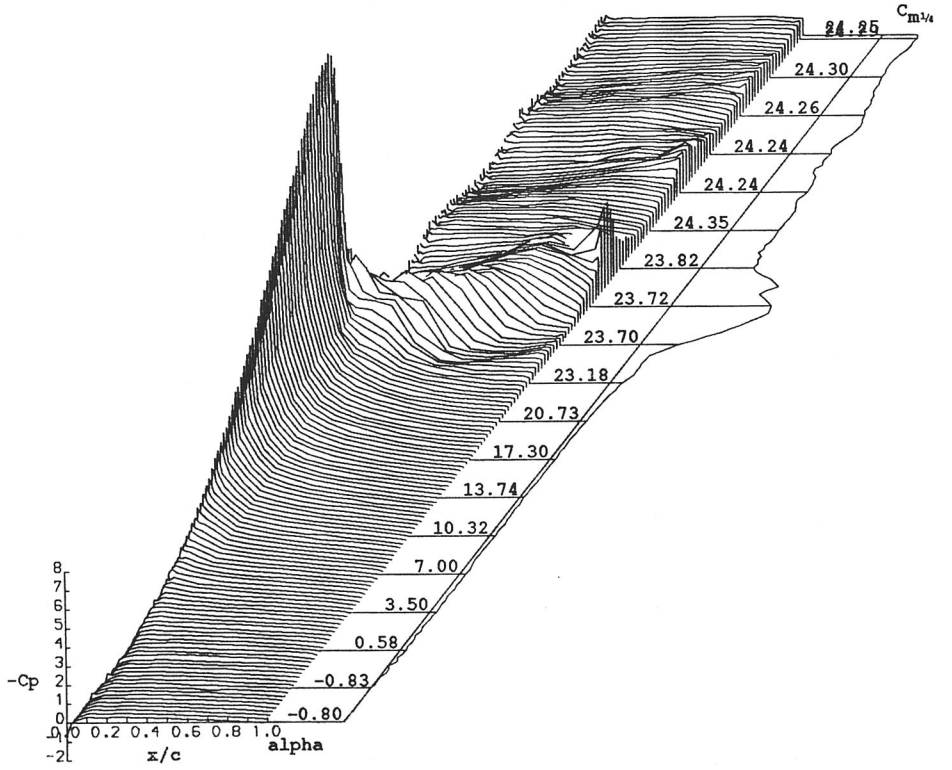


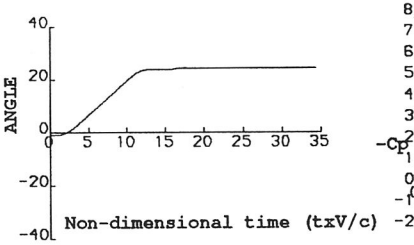


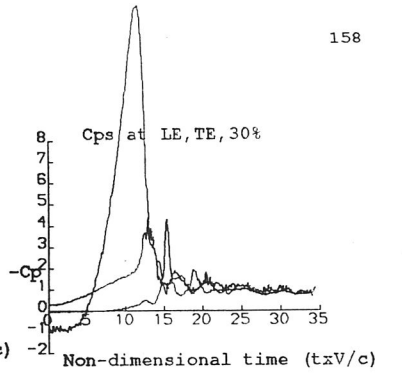
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

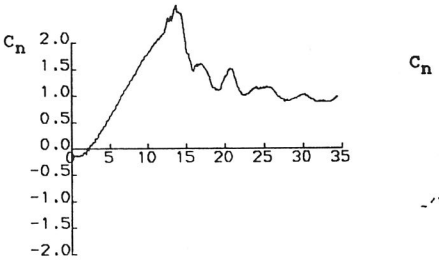
RUN REFERENCE NUMBER: 21581
REYNOLDS NUMBER = 1479672.
DYNAMIC PRESSURE = 992.49 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 25.000°
AVERAGED DATA OF 5 CYCLES

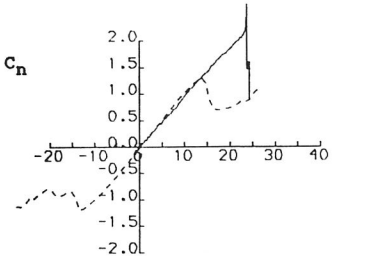
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.0°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02193
LINEAR PITCH RATE = 186.67°S^{-1}

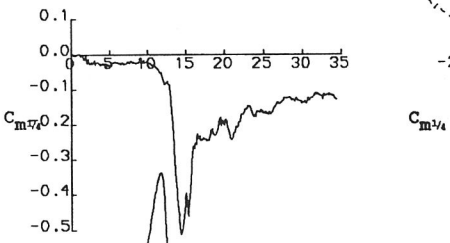


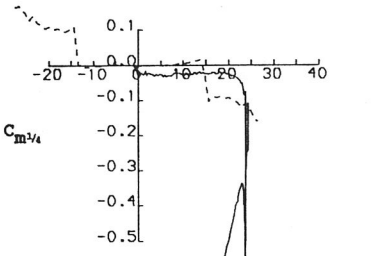


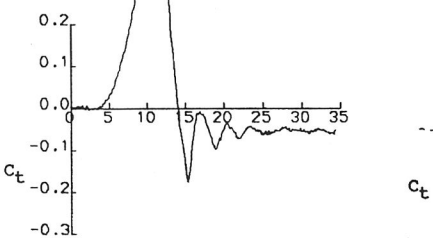


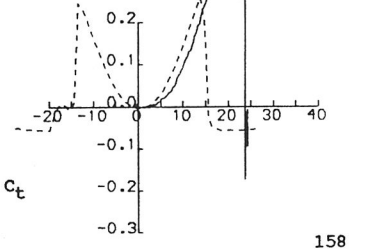








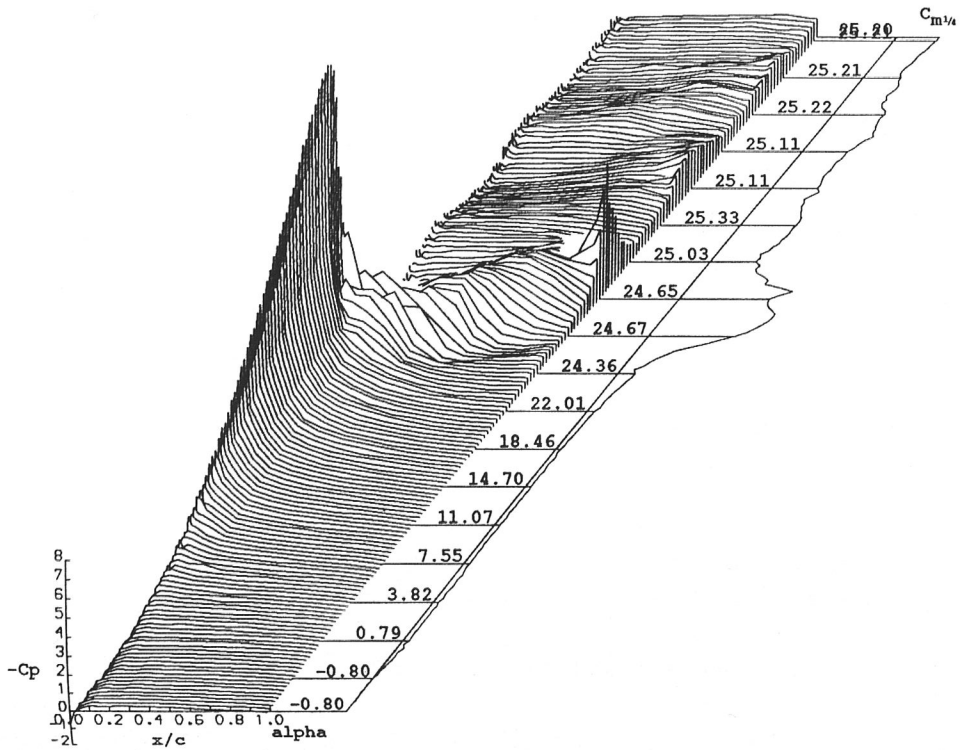


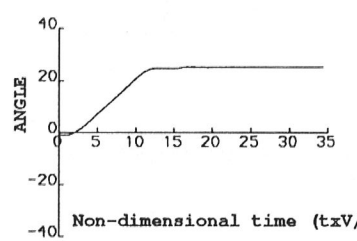


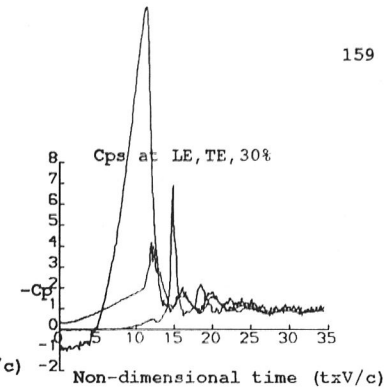
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

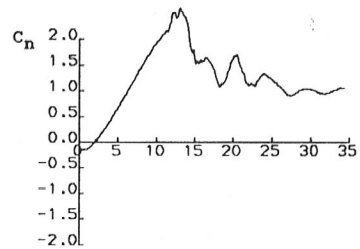
RUN REFERENCE NUMBER: 21591
REYNOLDS NUMBER = 1477131.
DYNAMIC PRESSURE = 992.49 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 26.000°
AVERAGED DATA OF 5 CYCLES

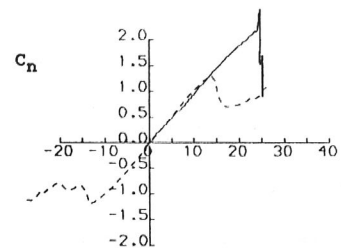
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.4°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02285
LINEAR PITCH RATE = 194.66°S^{-1}

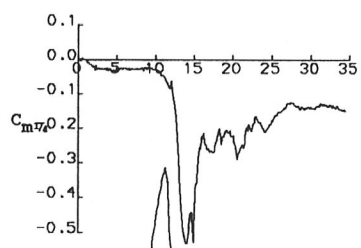


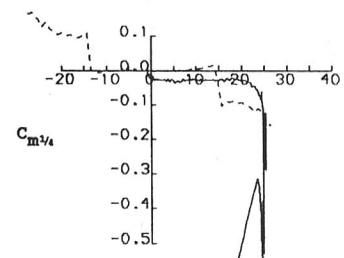


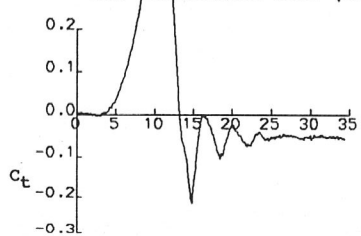


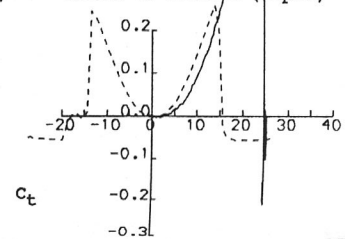








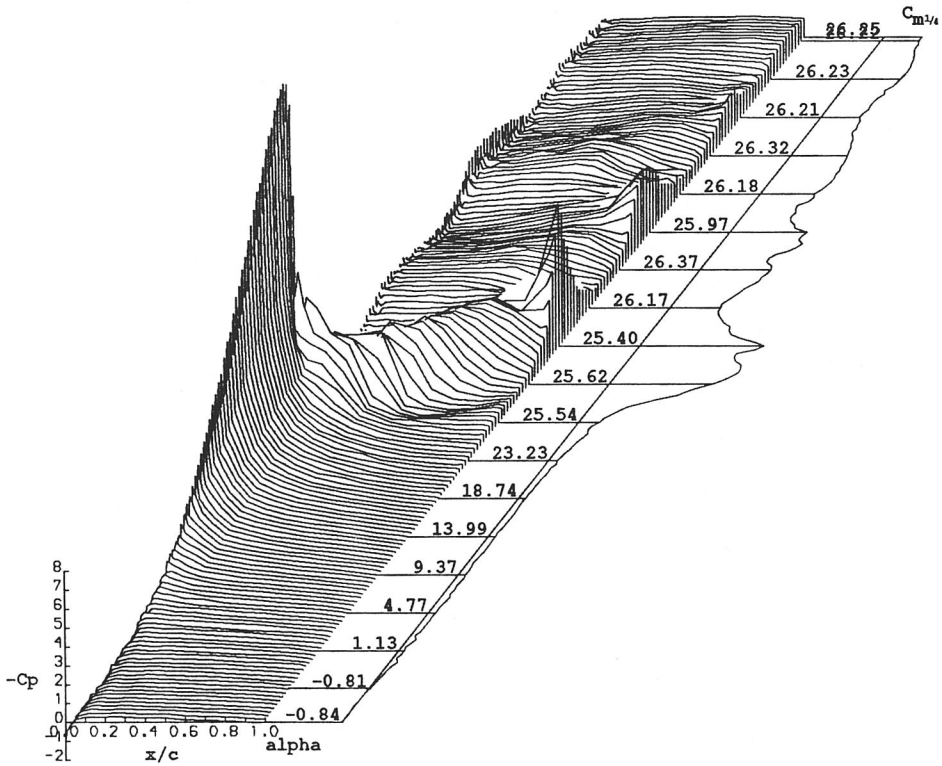


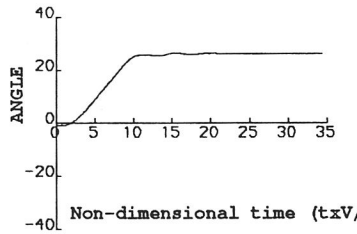


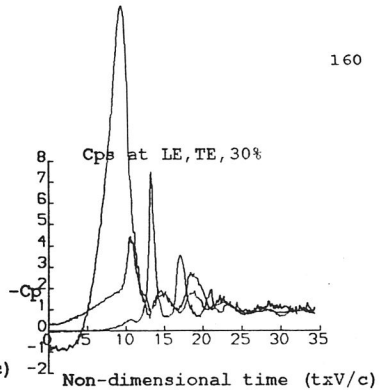
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

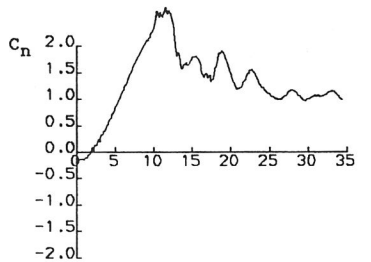
RUN REFERENCE NUMBER: 21601
REYNOLDS NUMBER = 1476497.
DYNAMIC PRESSURE = 992.49 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 27.000°
AVERAGED DATA OF 5 CYCLES

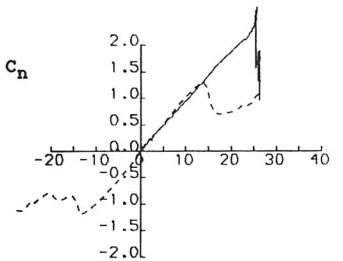
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02956
LINEAR PITCH RATE = 251.90°S^{-1}

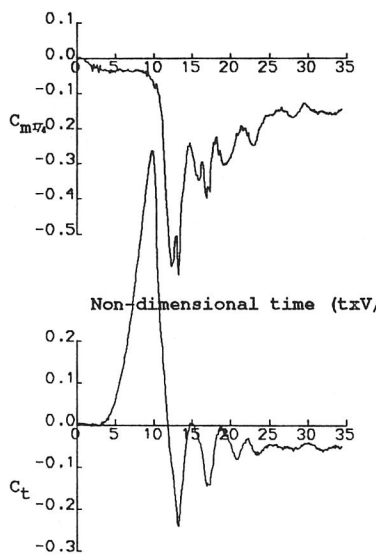


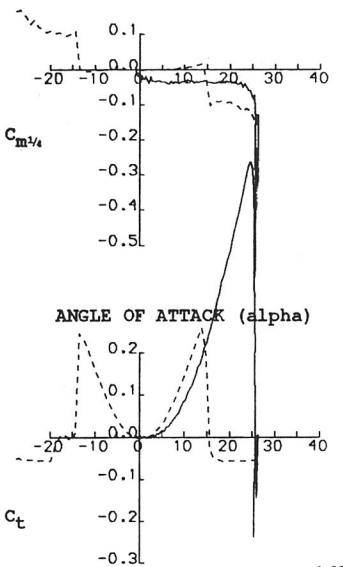








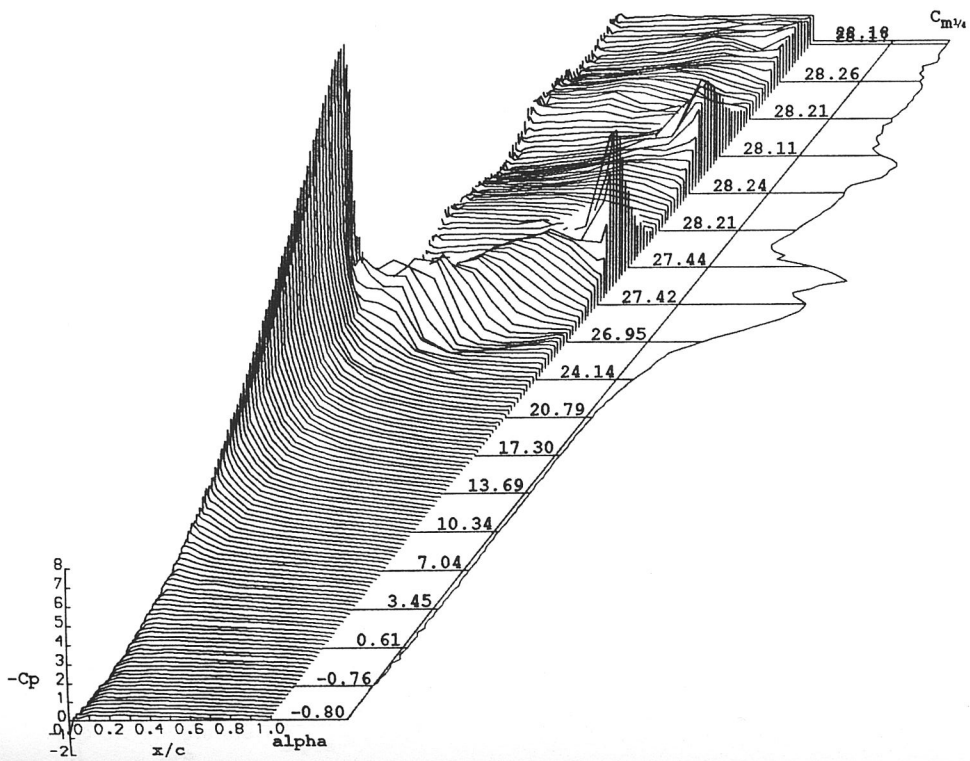


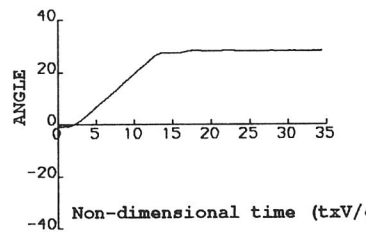


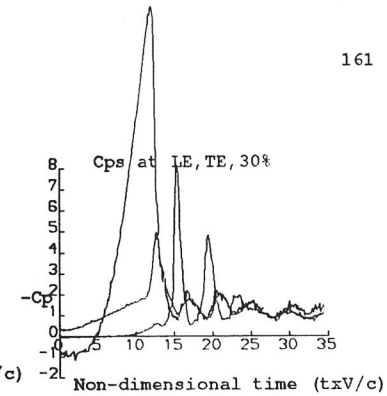
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

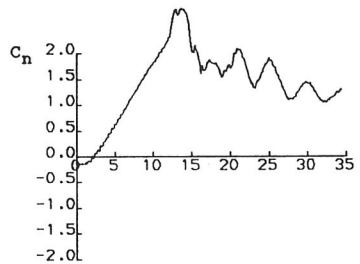
RUN REFERENCE NUMBER: 21611
REYNOLDS NUMBER = 1475231.
DYNAMIC PRESSURE = 992.49 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 29.000°
AVERAGED DATA OF 5 CYCLES

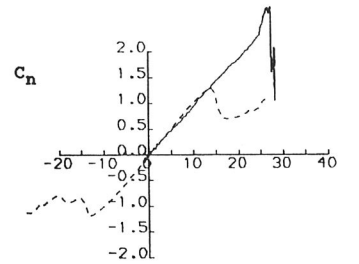
DATE OF TEST: 16/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02161
LINEAR PITCH RATE = 184.17°S^{-1}

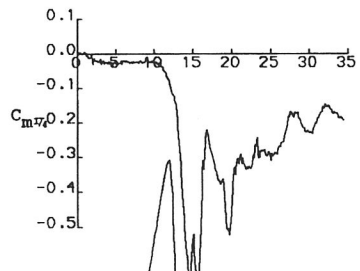


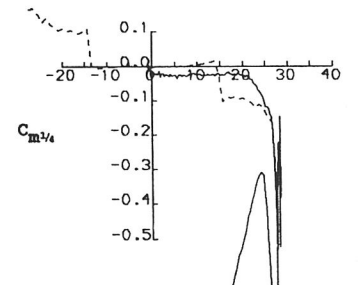


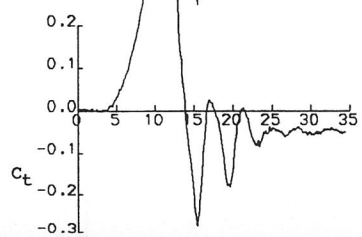


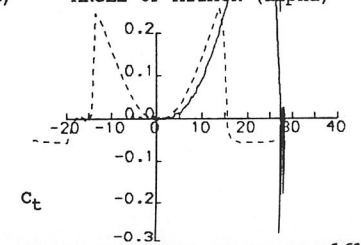








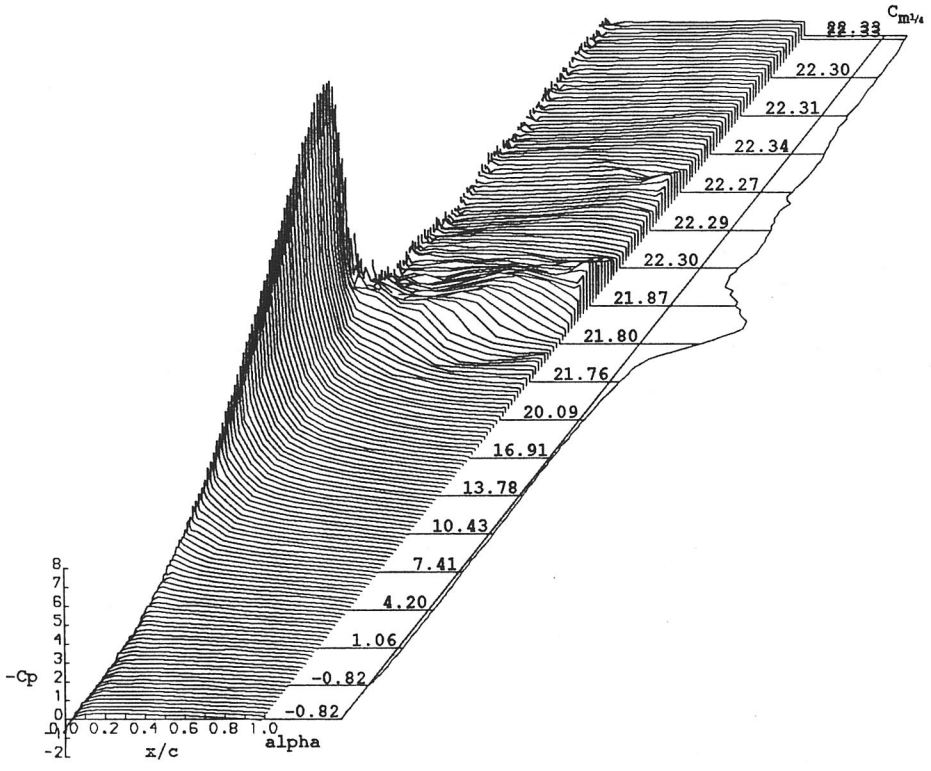


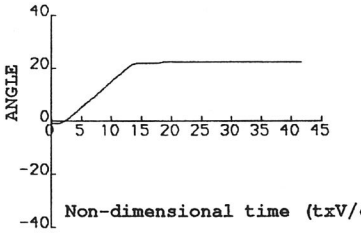


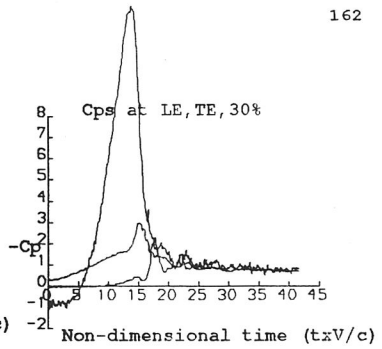
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

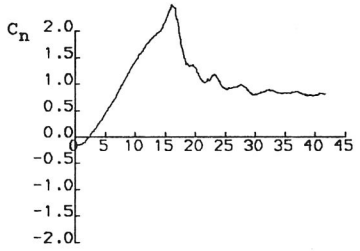
RUN REFERENCE NUMBER: 21621
REYNOLDS NUMBER = 1464696.
DYNAMIC PRESSURE = 975.01 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 23.000°
AVERAGED DATA OF 5 CYCLES

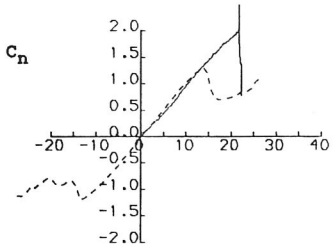
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 25.3°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01626
LINEAR PITCH RATE = 137.31°S^{-1}

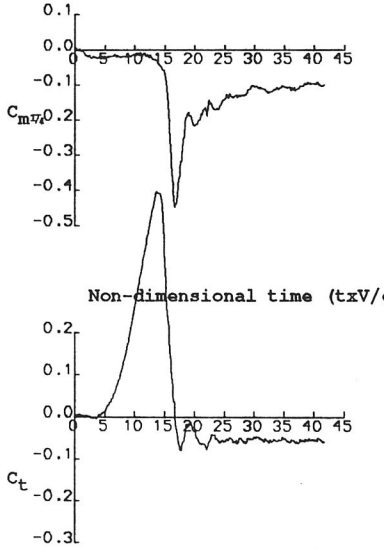


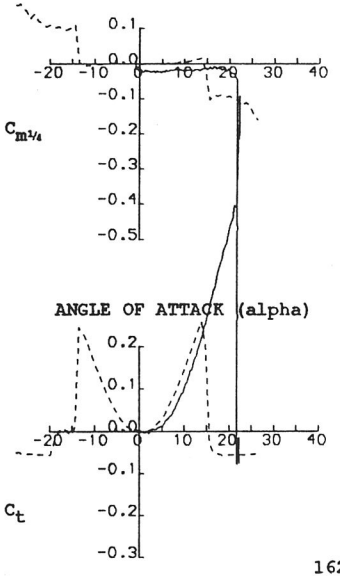








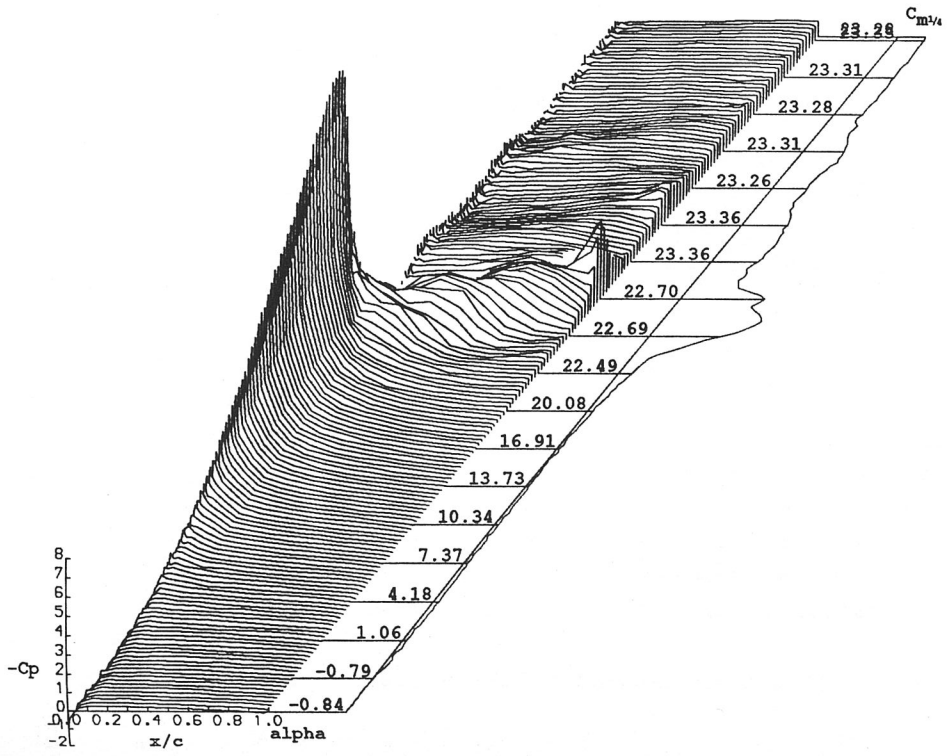


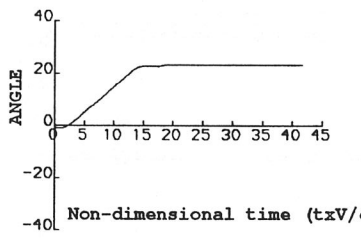


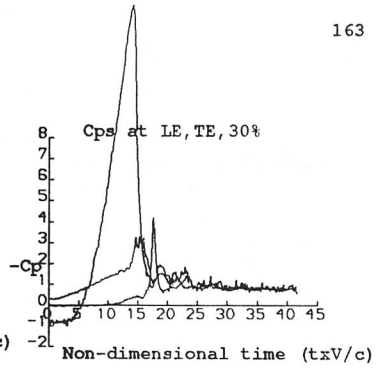
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

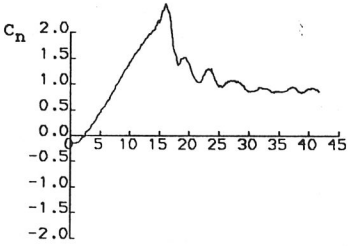
RUN REFERENCE NUMBER: 21631
REYNOLDS NUMBER = 1462812.
DYNAMIC PRESSURE = 975.01 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 24.000°
AVERAGED DATA OF 5 CYCLES

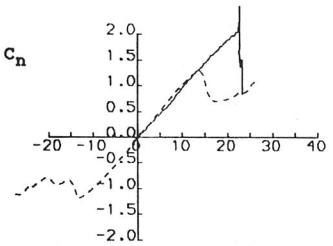
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 25.6°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01629
LINEAR PITCH RATE = 137.59°s^{-1}

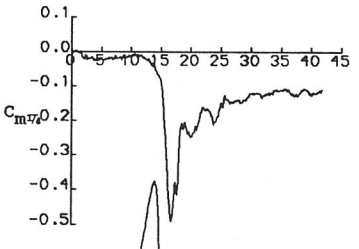


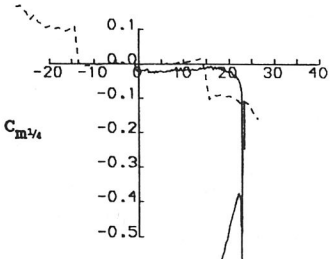


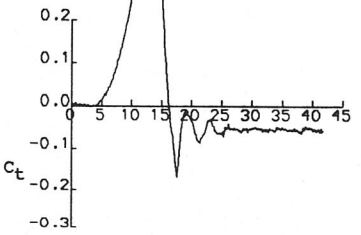


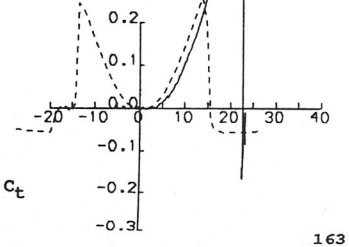








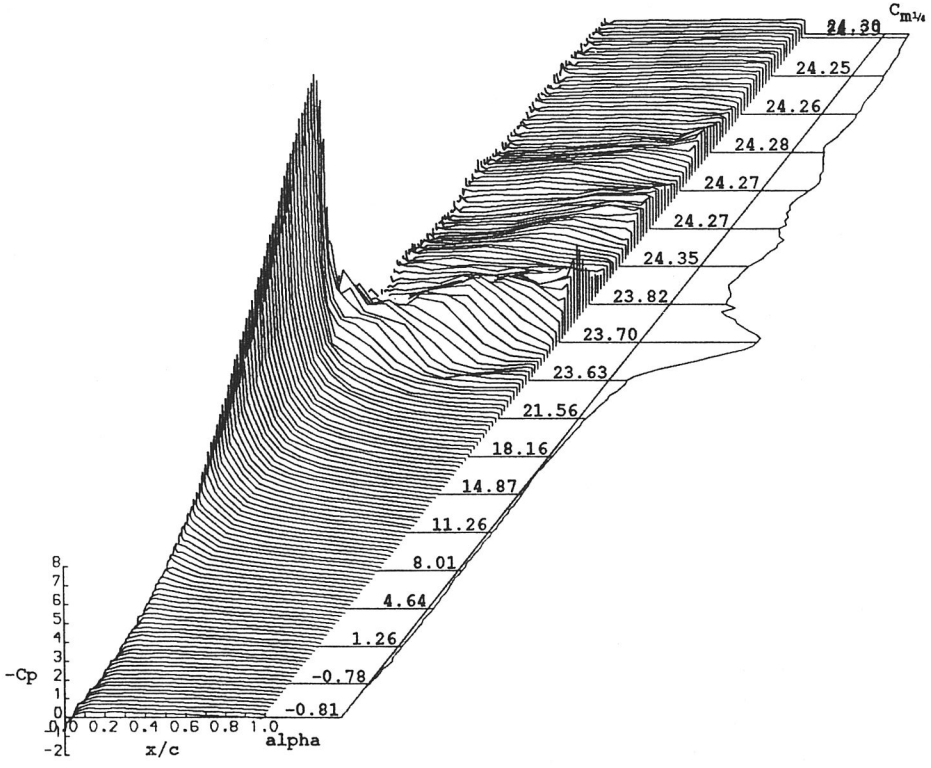


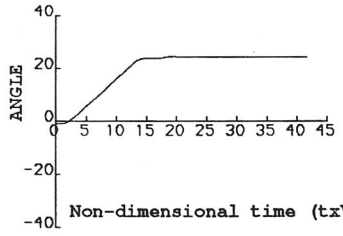


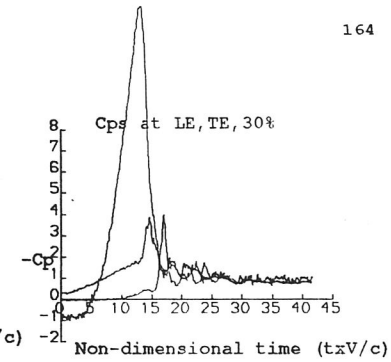
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

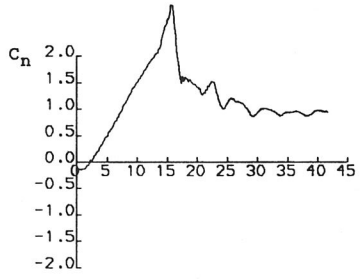
RUN REFERENCE NUMBER: 21641
REYNOLDS NUMBER = 1461558.
DYNAMIC PRESSURE = 975.01 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 25.000°
AVERAGED DATA OF 5 CYCLES

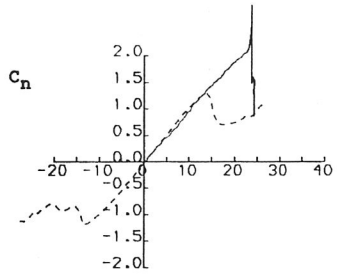
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 25.8°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01745
LINEAR PITCH RATE = 147.46°S^{-1}

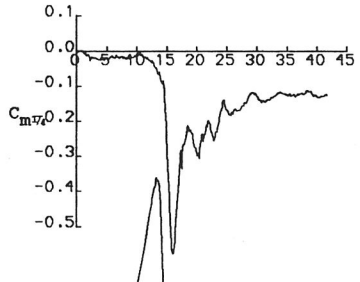


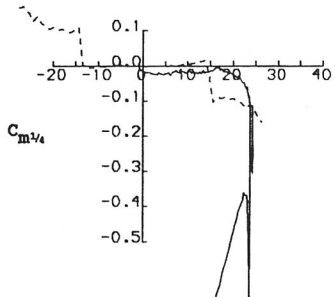


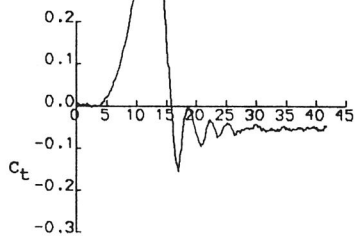


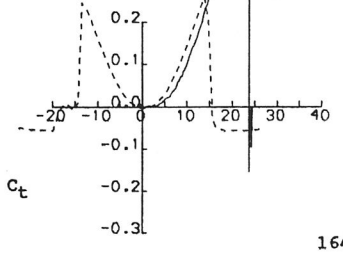








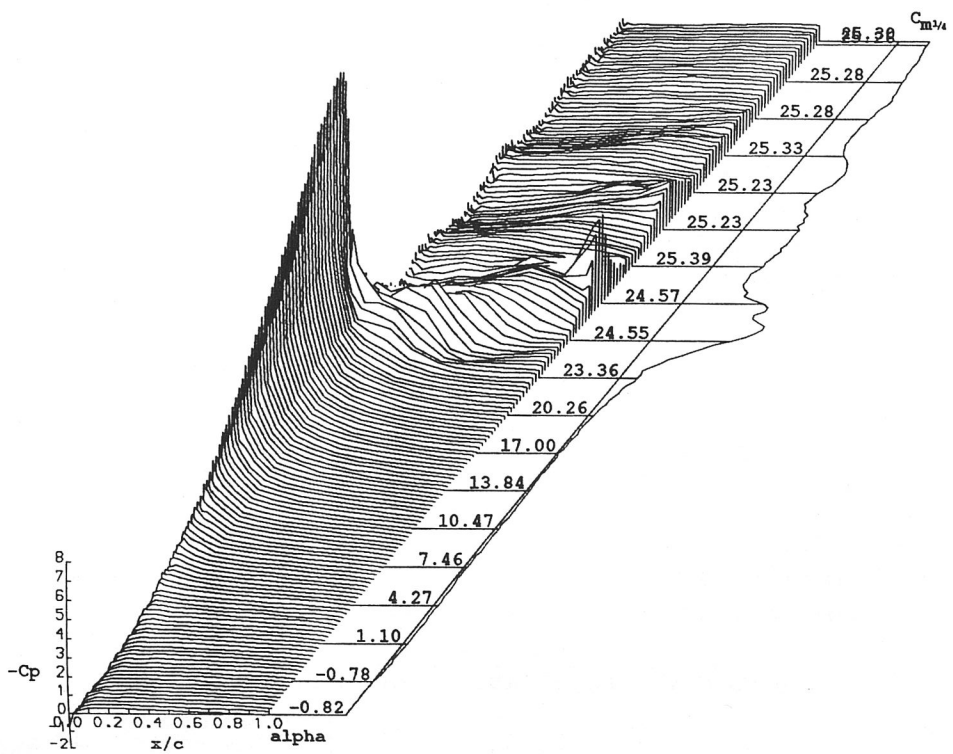


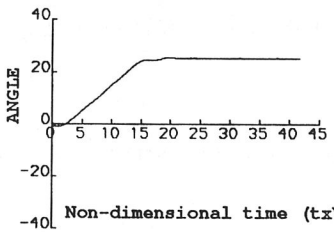


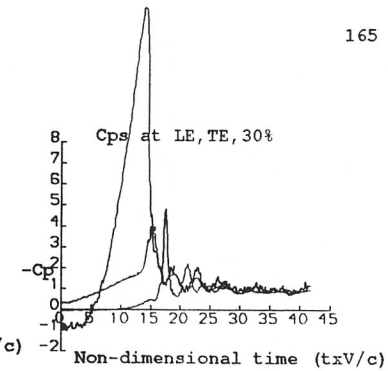
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

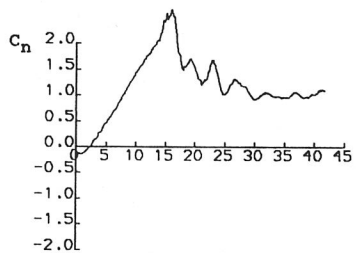
RUN REFERENCE NUMBER: 21651
REYNOLDS NUMBER = 1459681.
DYNAMIC PRESSURE = 975.01 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 26.000°
AVERAGED DATA OF 5 CYCLES

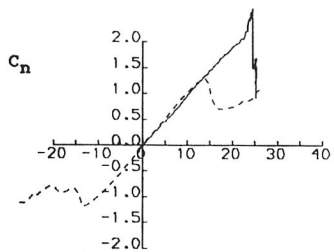
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.1°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01663
LINEAR PITCH RATE = 140.55°s^{-1}

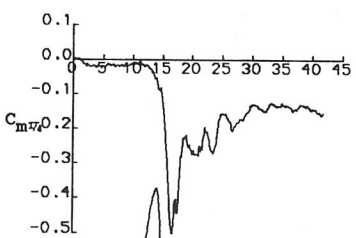


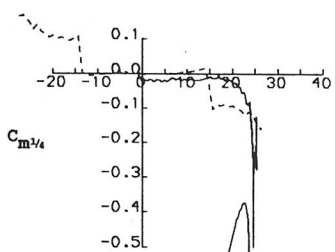


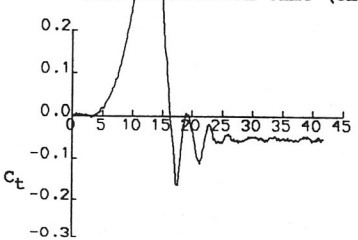


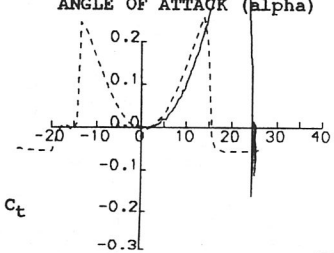








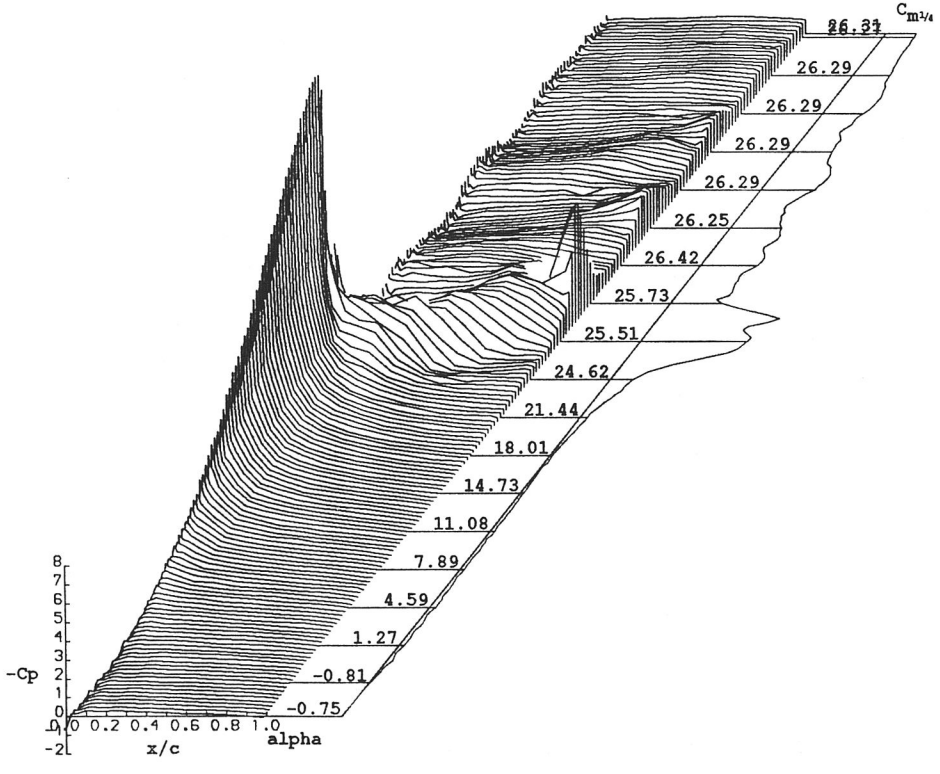


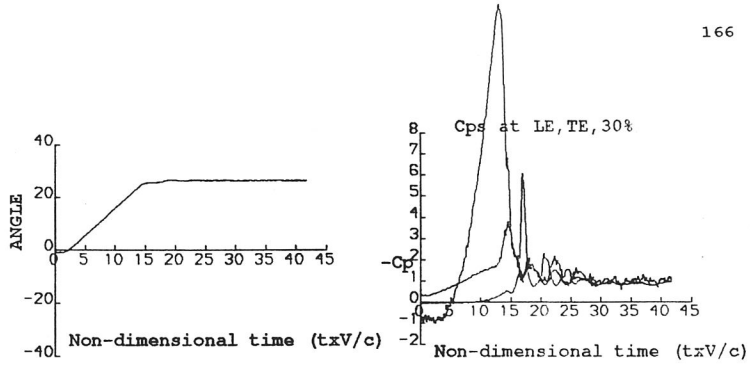


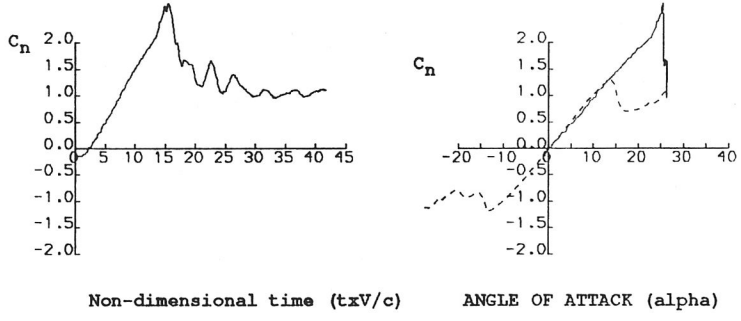
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

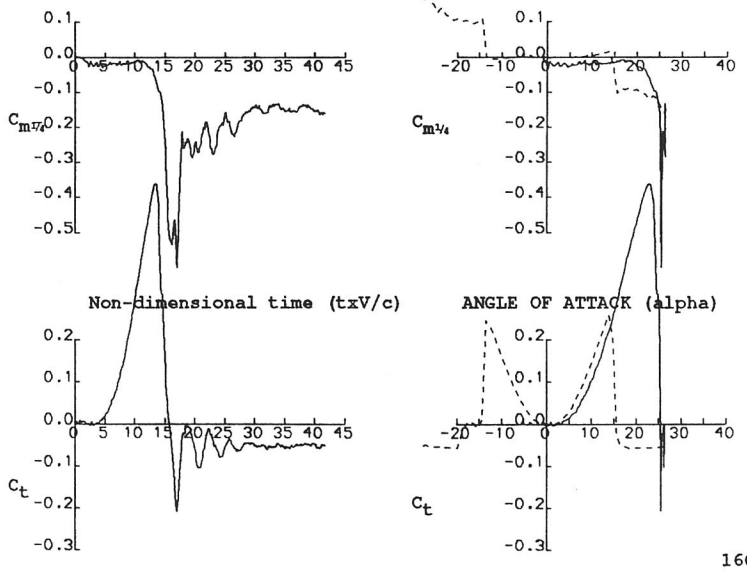
RUN REFERENCE NUMBER: 21661
REYNOLDS NUMBER = 1457809.
DYNAMIC PRESSURE = 975.01 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 27.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.4°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01727
LINEAR PITCH RATE = 146.11°S^{-1}





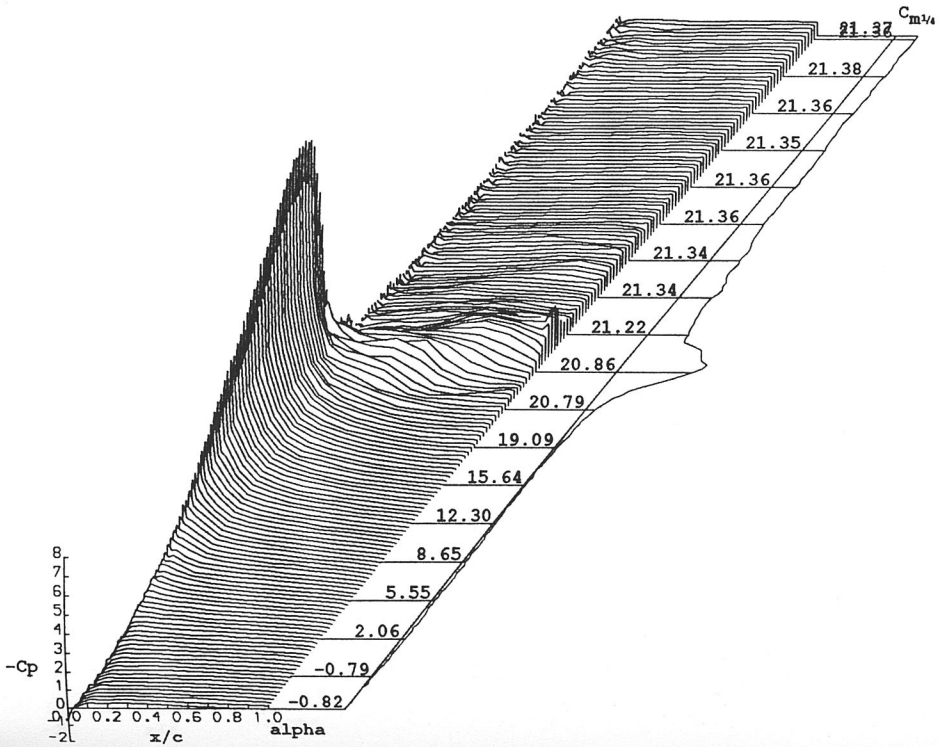


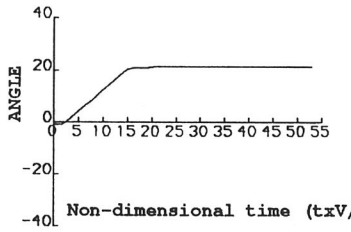


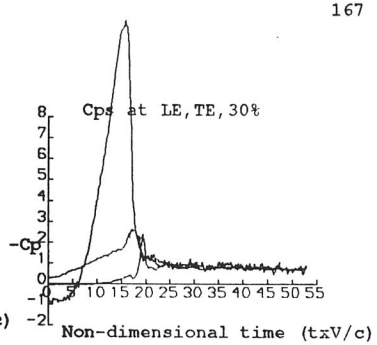
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

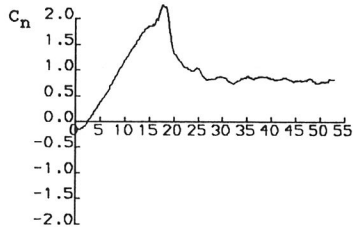
RUN REFERENCE NUMBER: 21671
REYNOLDS NUMBER = 1464899.
DYNAMIC PRESSURE = 980.31 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 22.000°
AVERAGED DATA OF 5 CYCLES

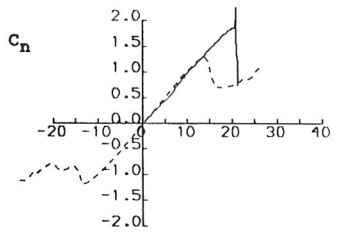
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 25.9°C
SAMPLING FREQUENCY = 354.99 Hz.
REDUCED PITCH RATE = 0.01384
LINEAR PITCH RATE = 117.27°S^{-1}

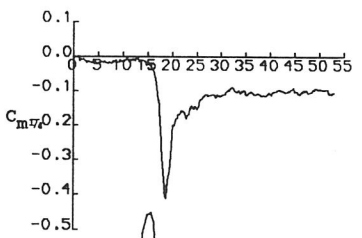


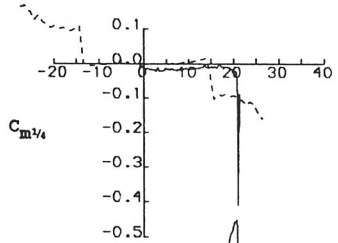


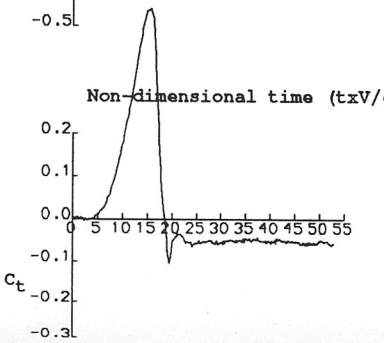


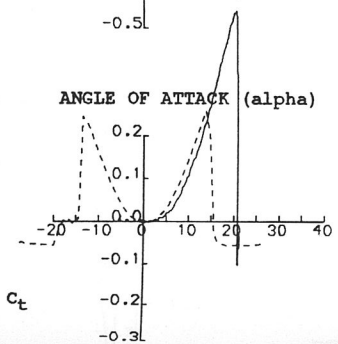








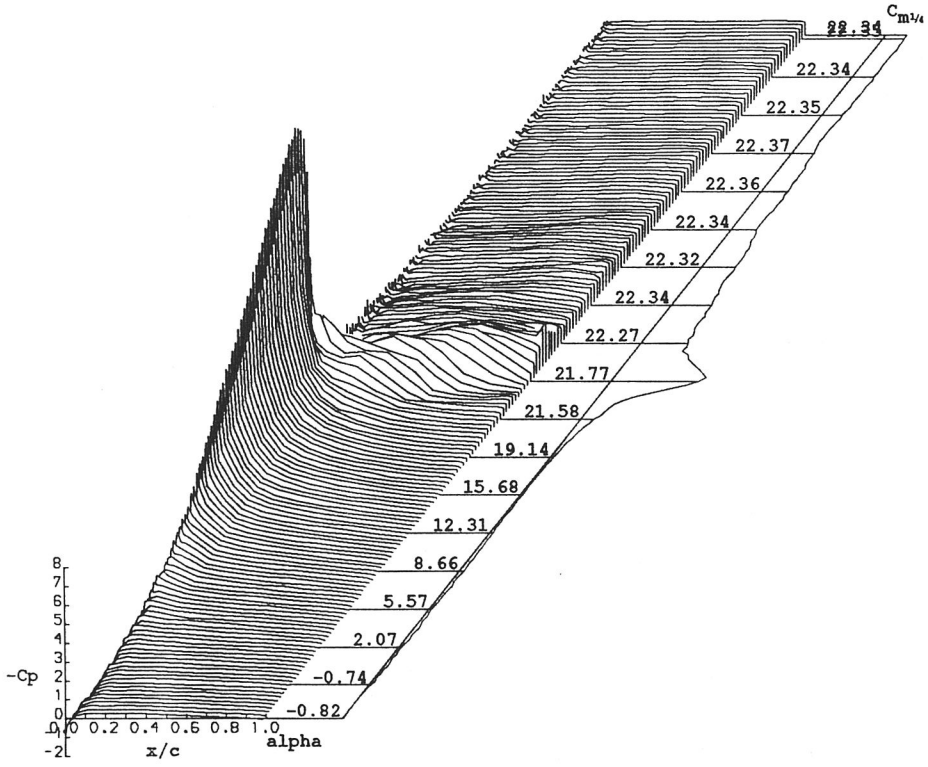


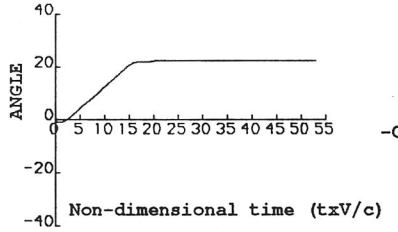


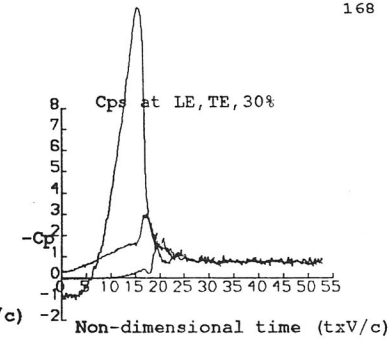
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

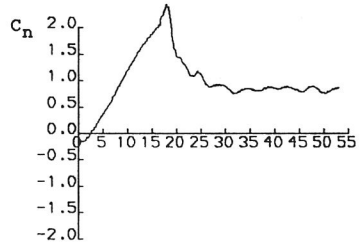
RUN REFERENCE NUMBER: 21681
REYNOLDS NUMBER = 1463645.
DYNAMIC PRESSURE = 980.31 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 23.000°
AVERAGED DATA OF 5 CYCLES

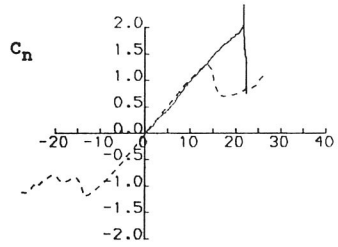
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.1°C
SAMPLING FREQUENCY = 354.99 Hz.
REDUCED PITCH RATE = 0.01398
LINEAR PITCH RATE = 118.51°S^{-1}

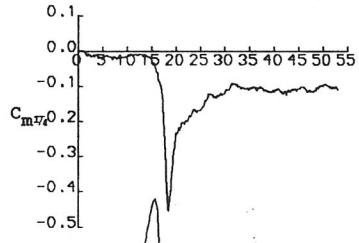


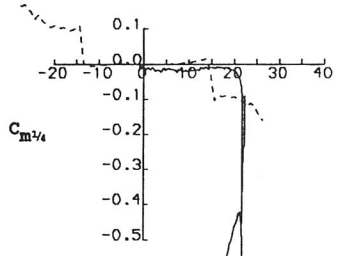


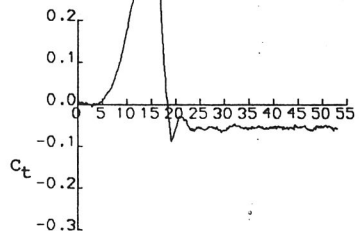


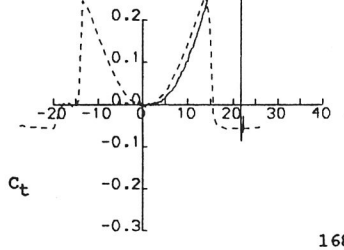








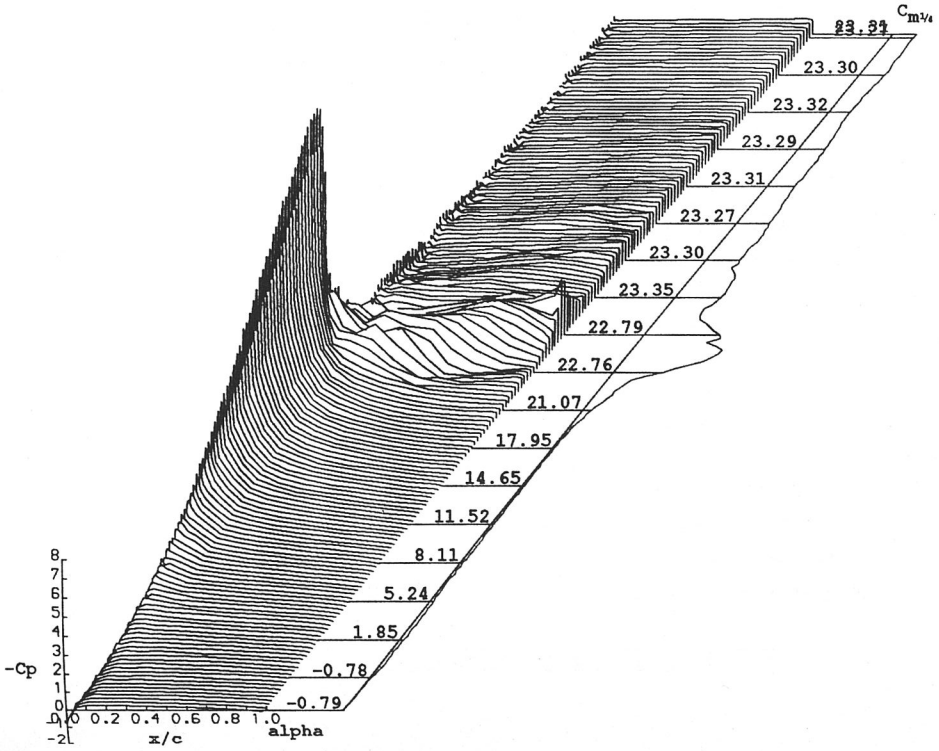


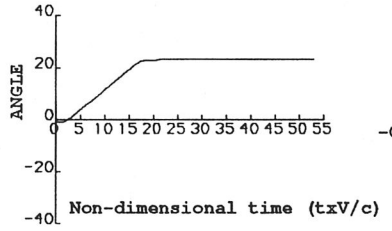


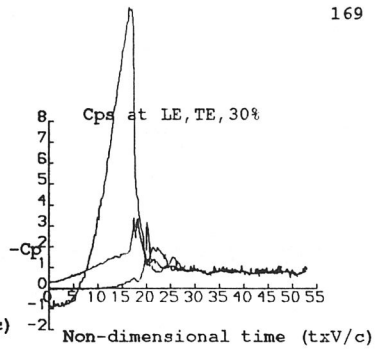
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

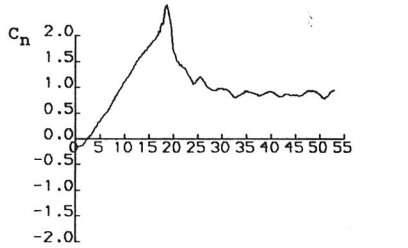
RUN REFERENCE NUMBER: 21691
REYNOLDS NUMBER = 1461768.
DYNAMIC PRESSURE = 980.31 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 24.000°
AVERAGED DATA OF 5 CYCLES

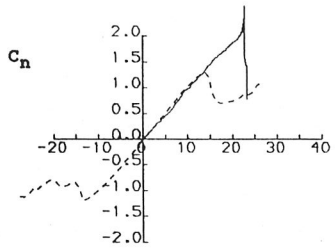
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.4°C
SAMPLING FREQUENCY = 354.99 Hz.
REDUCED PITCH RATE = 0.01324
LINEAR PITCH RATE = 112.26°S^{-1}

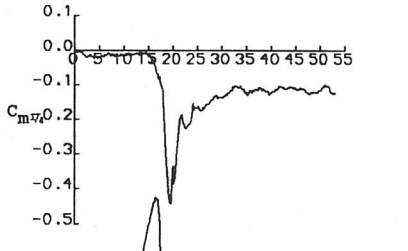


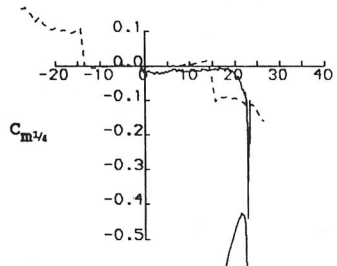


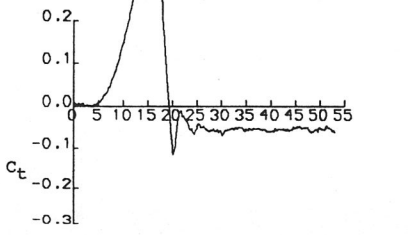


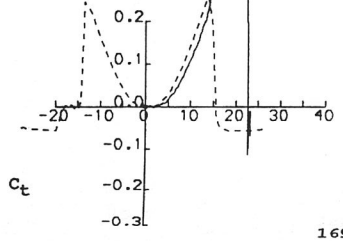






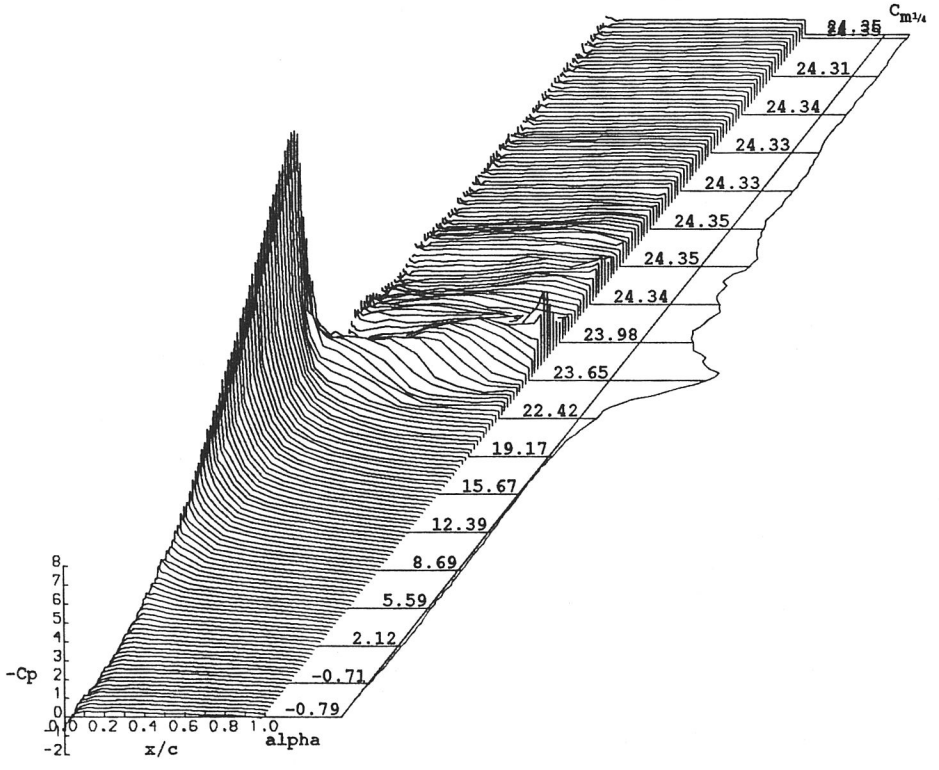


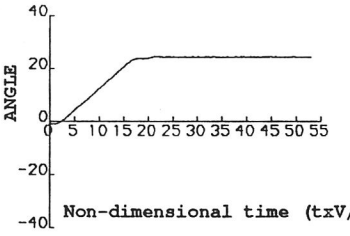


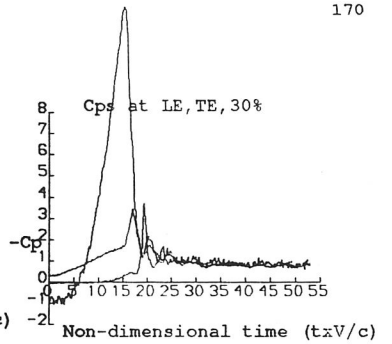


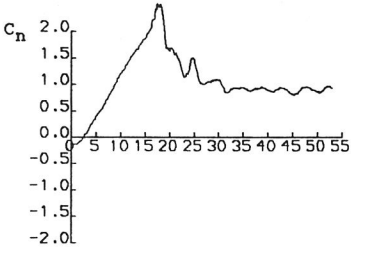
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

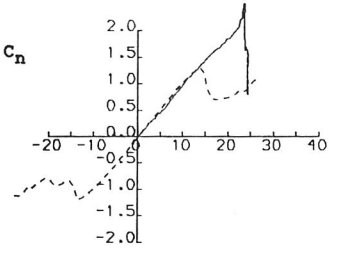
RUN REFERENCE NUMBER: 21701
DATE OF TEST: 16/1/91
REYNOLDS NUMBER = 1461143.
MACH NUMBER = 0.117
DYNAMIC PRESSURE = 980.31 Nm^{-2}
AIR TEMPERATURE = 26.5°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 354.99 Hz.
MOTION TYPE: RAMP UP
REDUCED PITCH RATE = 0.01407
START ANGLE = -1.00°
LINEAR PITCH RATE = 119.33°S^{-1}
RAMP ARC = 25.000°
AVERAGED DATA OF 5 CYCLES

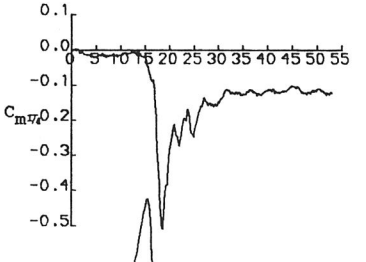


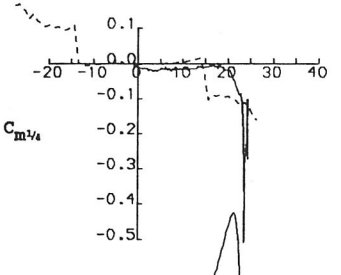


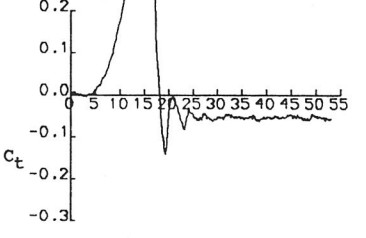


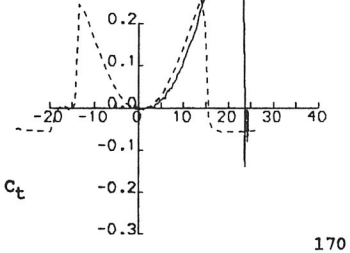








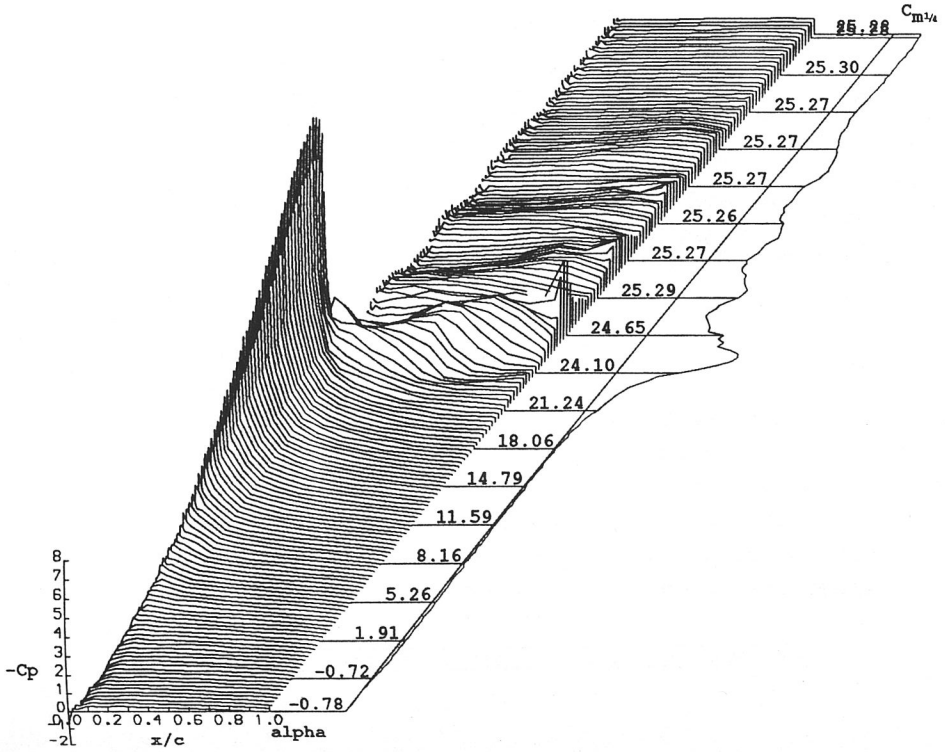


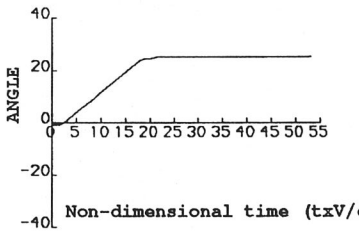


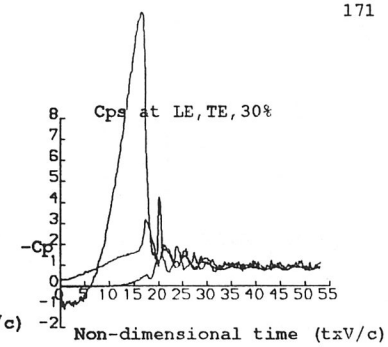
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

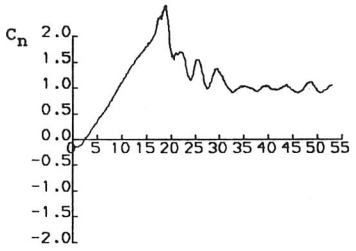
RUN REFERENCE NUMBER: 21711
REYNOLDS NUMBER = 1458649.
DYNAMIC PRESSURE = 980.31 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 26.000°
AVERAGED DATA OF 5 CYCLES

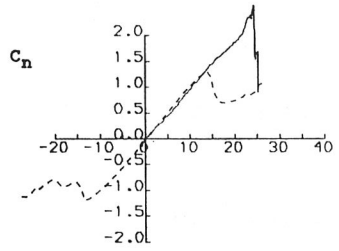
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.9°C
SAMPLING FREQUENCY = 354.99 Hz.
REDUCED PITCH RATE = 0.01348
LINEAR PITCH RATE = 114.41°S^{-1}

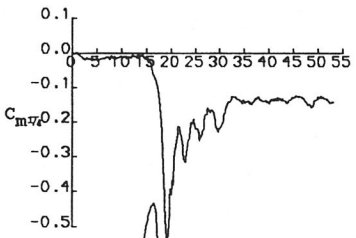


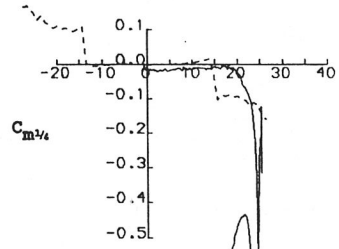






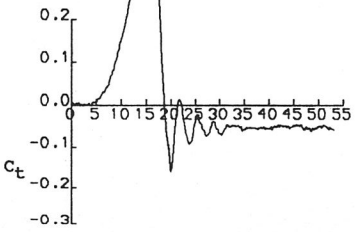


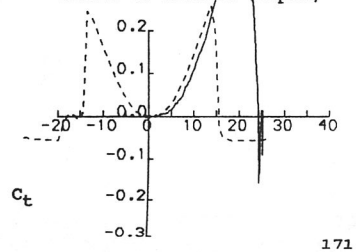




Non-dimensional time (txV/c)

ANGLE OF ATTACK (alpha)

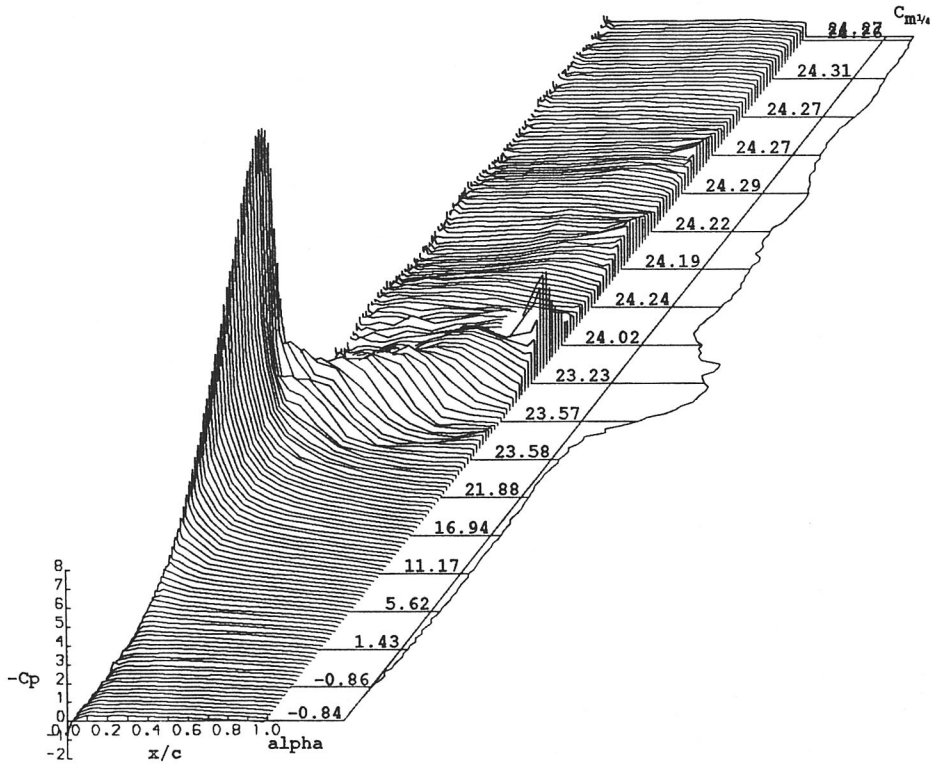


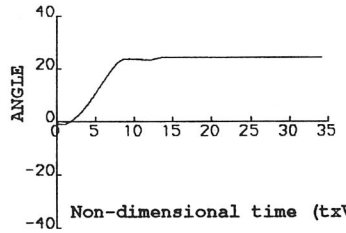


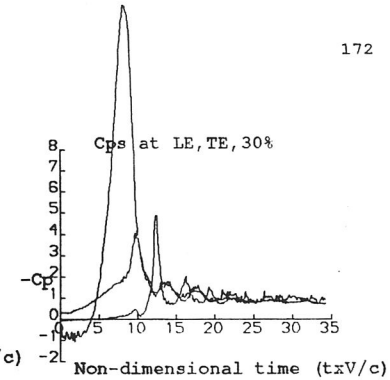
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

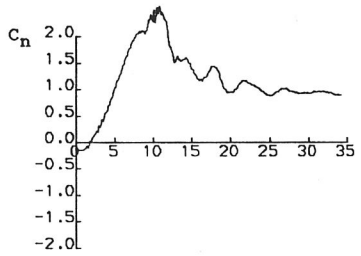
RUN REFERENCE NUMBER: 21721
REYNOLDS NUMBER = 1459848.
DYNAMIC PRESSURE = 977.74 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 25.000°
AVERAGED DATA OF 5 CYCLES

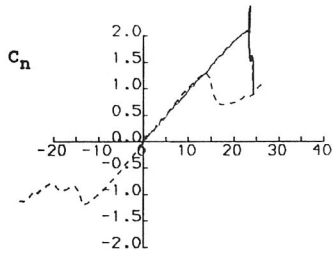
DATE OF TEST: 16/1/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.4°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03678
LINEAR PITCH RATE = 311.54°S^{-1}

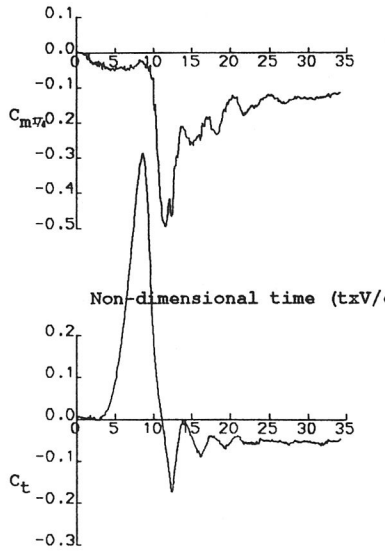


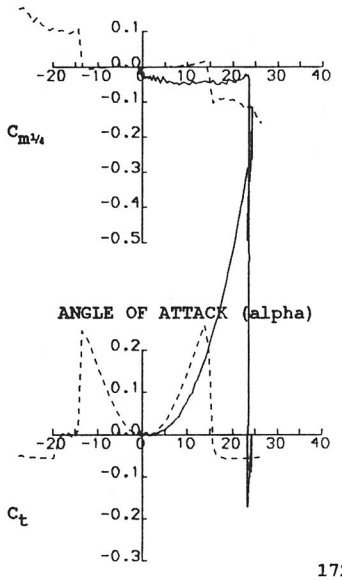








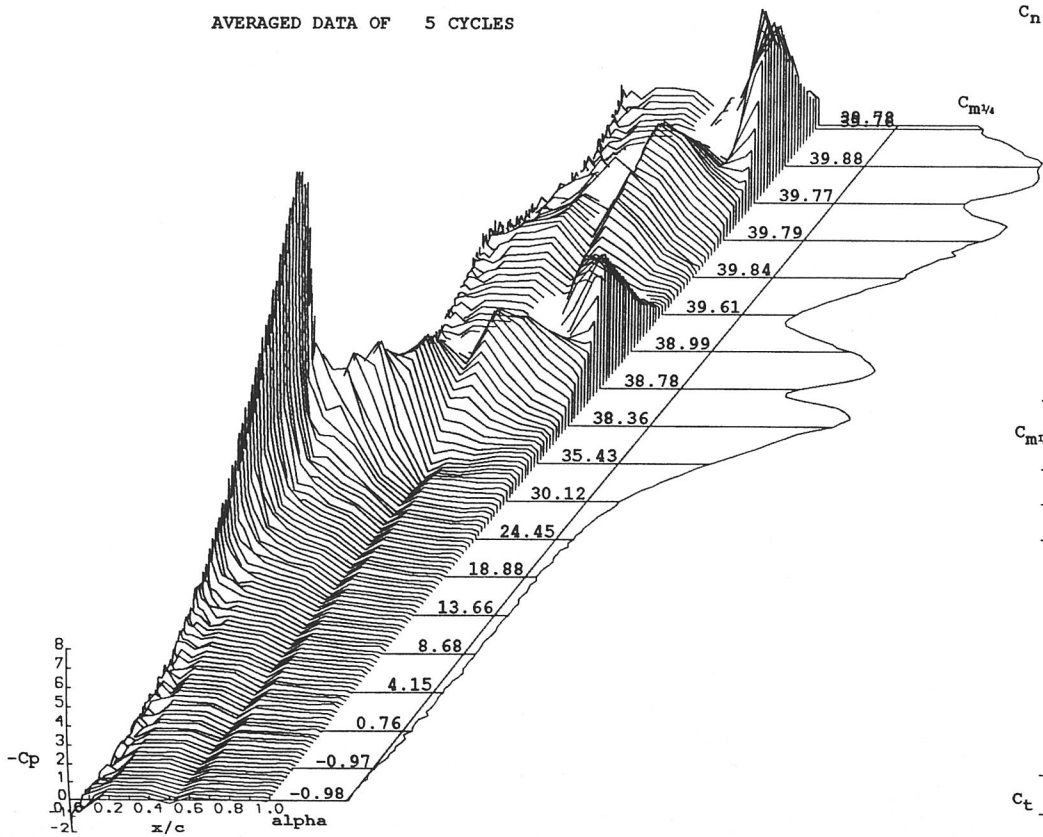


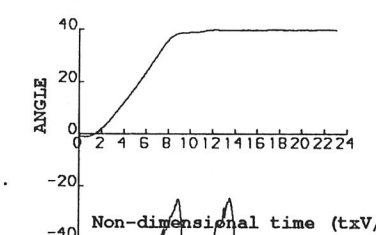


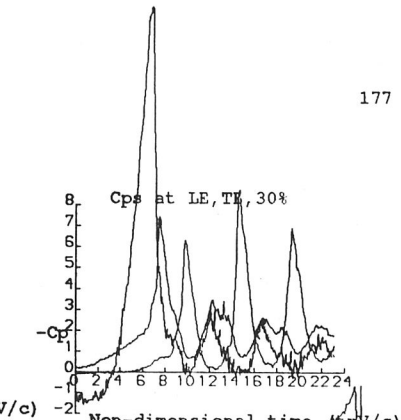
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

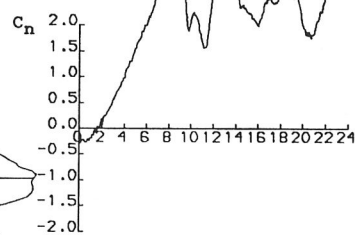
RUN REFERENCE NUMBER: 21771
REYNOLDS NUMBER = 1018652.
DYNAMIC PRESSURE = 457.45 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

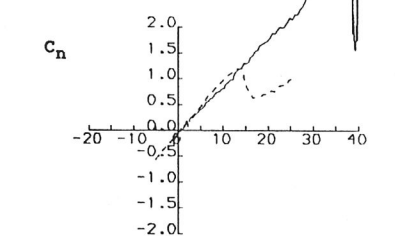
DATE OF TEST: 22/1/91
MACH NUMBER = 0.079
AIR TEMPERATURE = 24.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.04930
LINEAR PITCH RATE = 281.54°S^{-1}

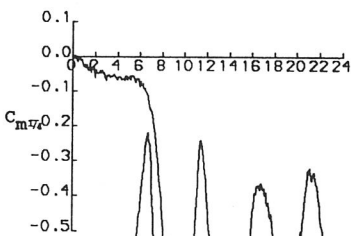


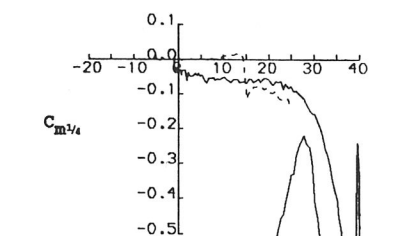


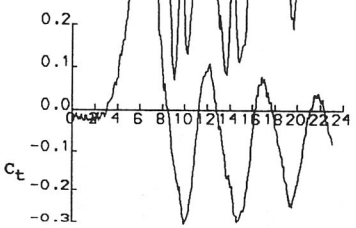


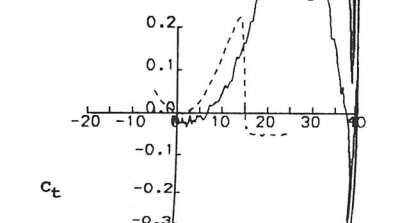








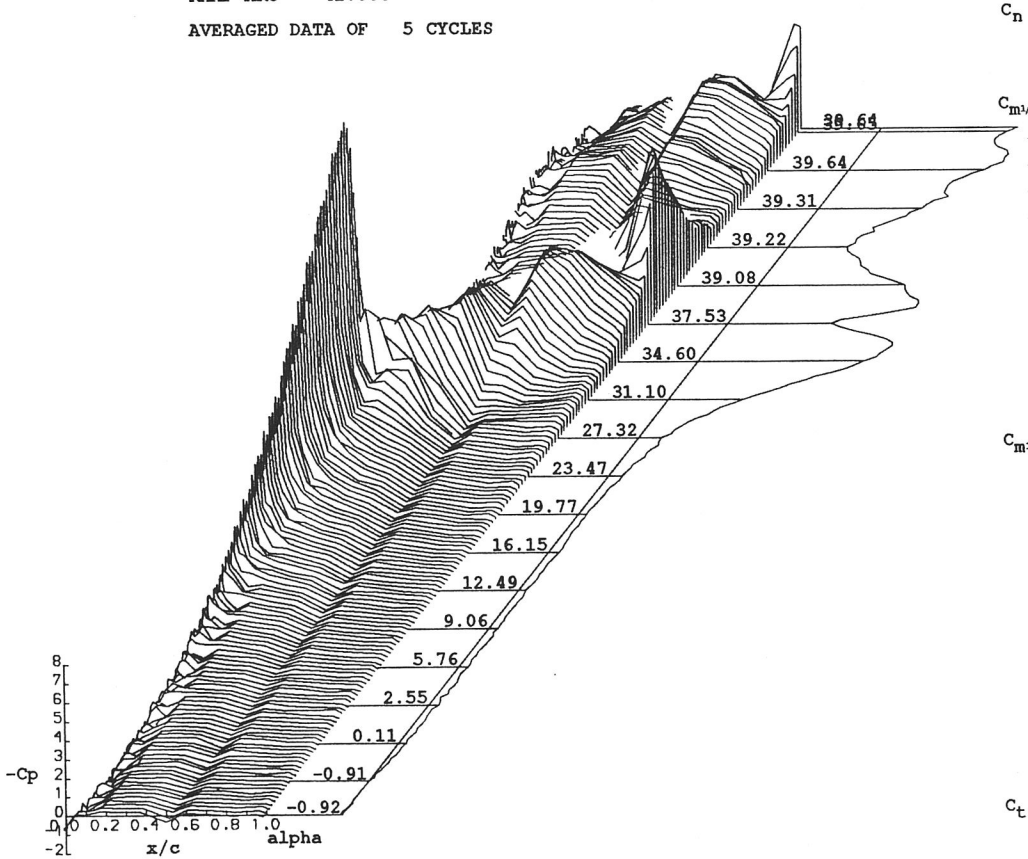


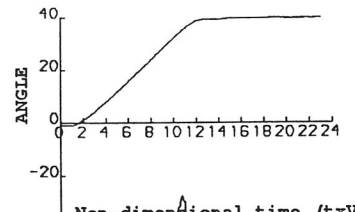


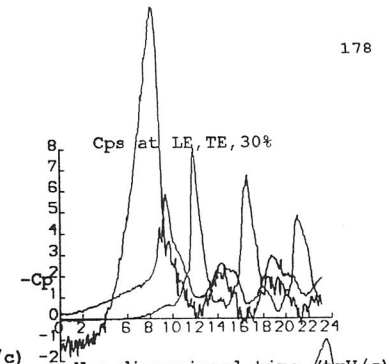
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

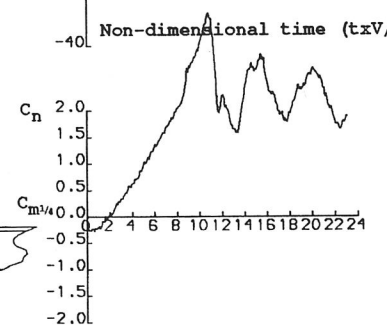
RUN REFERENCE NUMBER: 21781
REYNOLDS NUMBER = 1016898.
DYNAMIC PRESSURE = 457.45 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

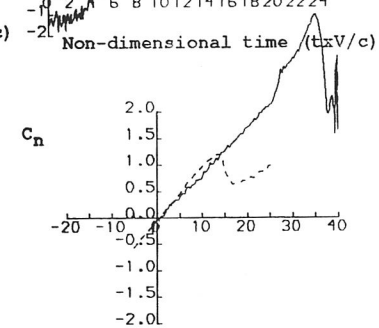
DATE OF TEST: 22/1/91
MACH NUMBER = 0.079
AIR TEMPERATURE = 24.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03492
LINEAR PITCH RATE = 199.56°S^{-1}

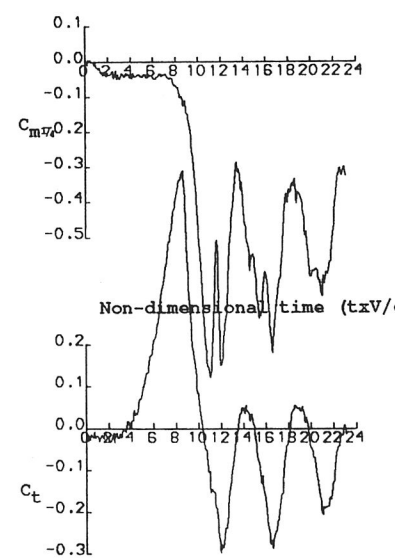


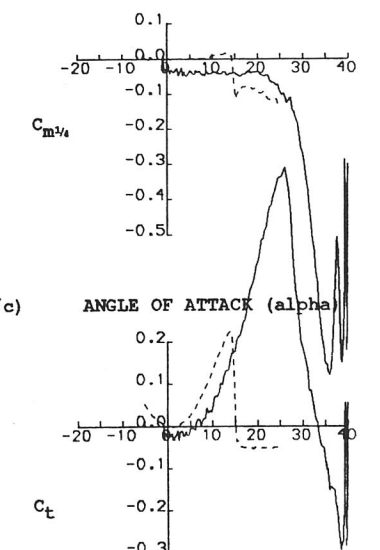








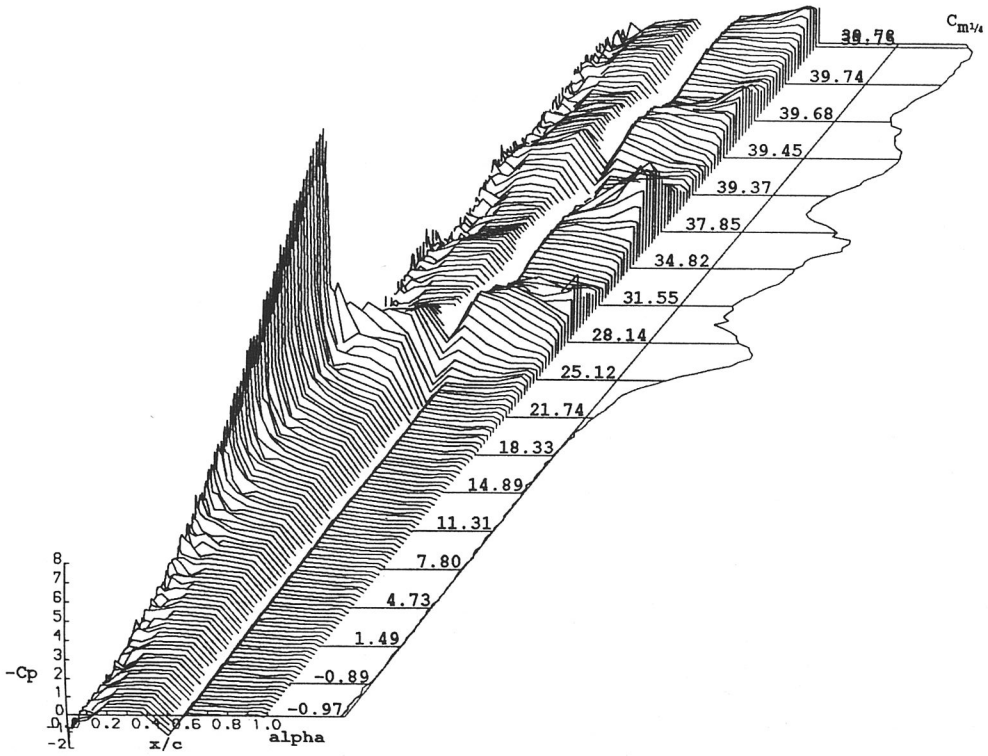


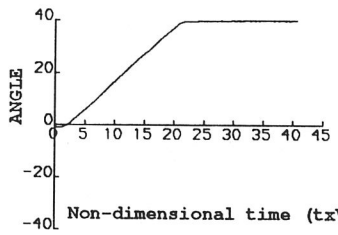


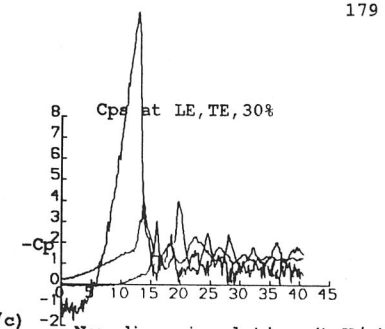
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

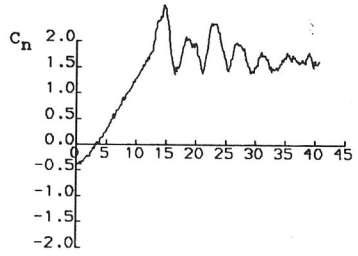
RUN REFERENCE NUMBER: 21791
REYNOLDS NUMBER = 1016898.
DYNAMIC PRESSURE = 457.45 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

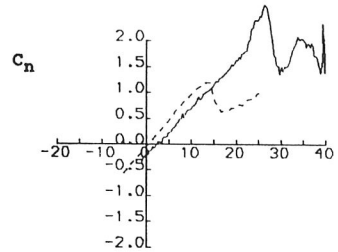
DATE OF TEST: 22/1/91
MACH NUMBER = 0.079
AIR TEMPERATURE = 24.7°C
SAMPLING FREQUENCY = 312.01 Hz.
REDUCED PITCH RATE = 0.01885
LINEAR PITCH RATE = 107.72°S^{-1}

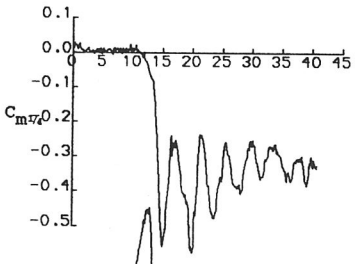


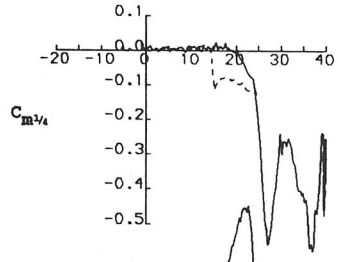


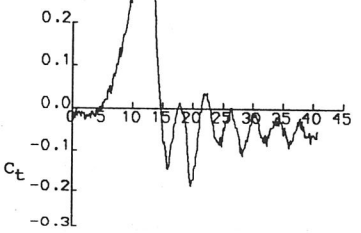


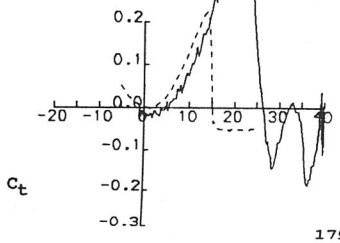






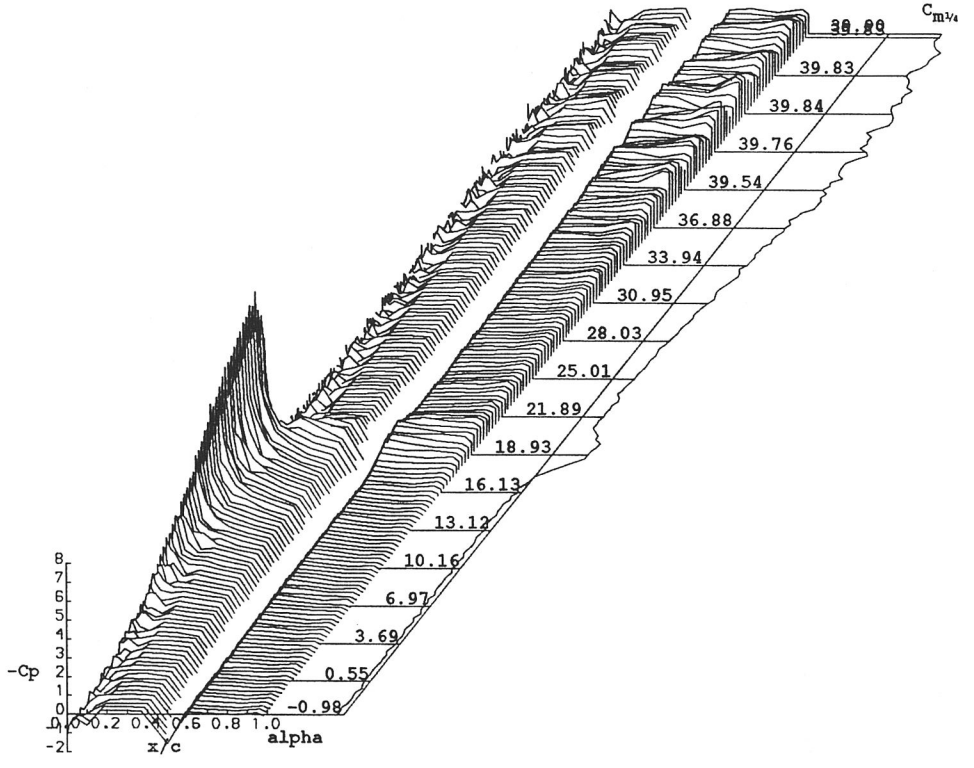


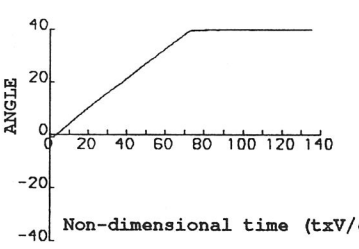


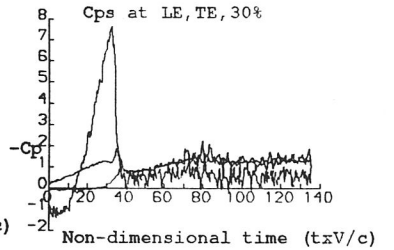


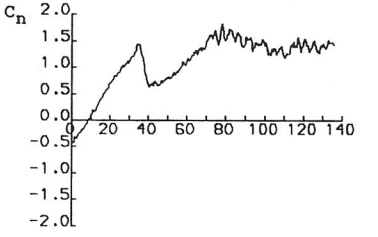
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

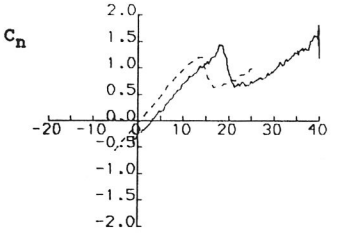
RUN REFERENCE NUMBER: 21801
DATE OF TEST: 22/1/91
REYNOLDS NUMBER = 1016898.
MACH NUMBER = 0.079
DYNAMIC PRESSURE = 457.45 Nm^{-2}
AIR TEMPERATURE = 24.7°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 93.70 Hz.
MOTION TYPE: RAMP UP
REDUCED PITCH RATE = 0.00474
START ANGLE = -1.00°
LINEAR PITCH RATE = 27.08°S^{-1}
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

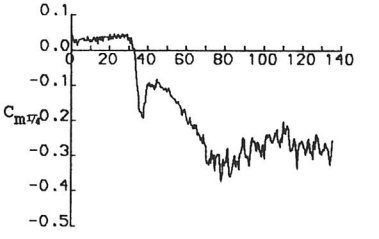


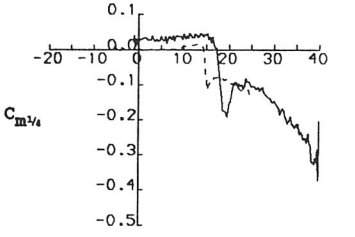


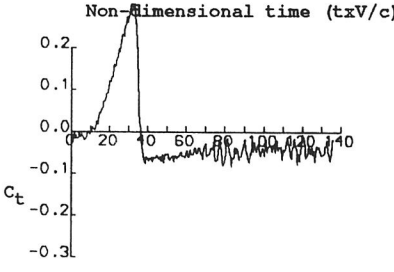


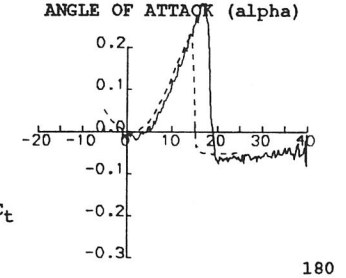








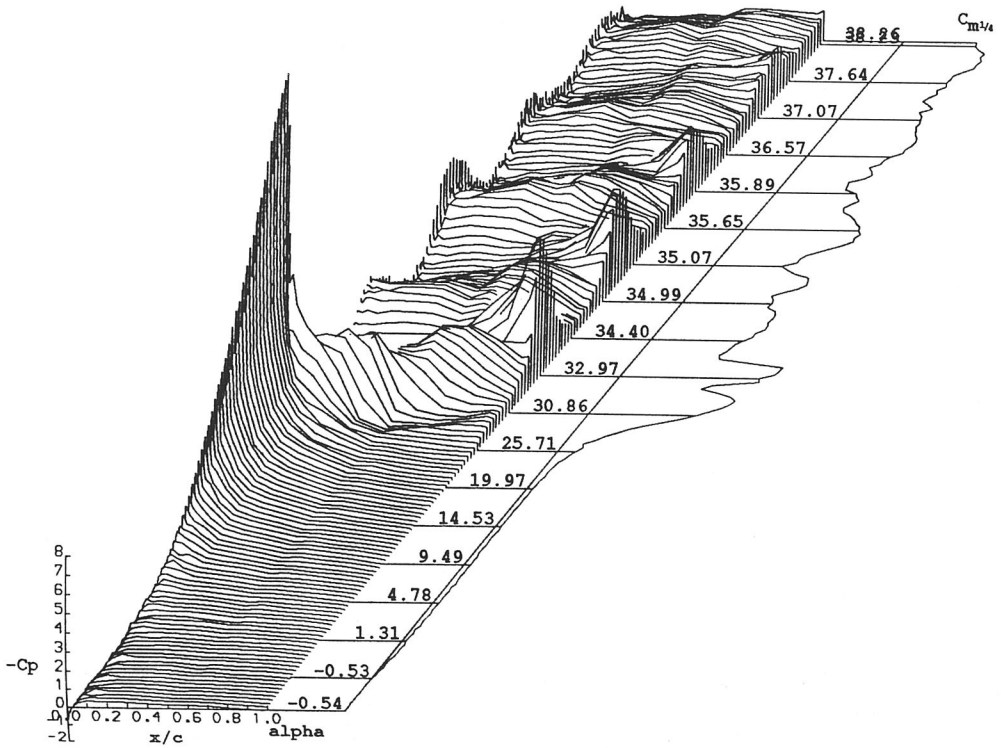


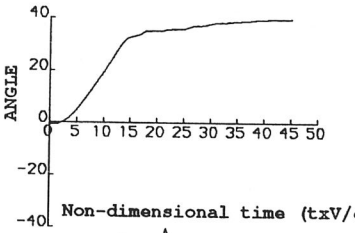


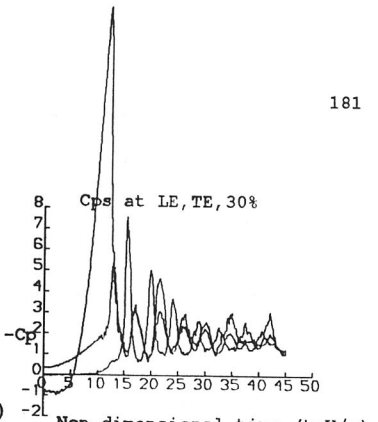
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

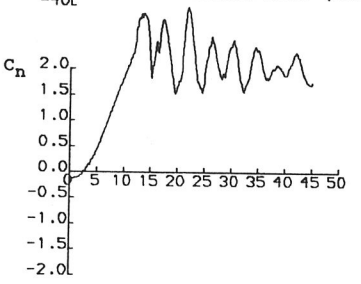
RUN REFERENCE NUMBER: 21811
REYNOLDS NUMBER = 1961130.
DYNAMIC PRESSURE = 1732.29 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

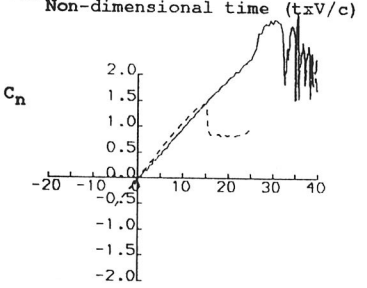
DATE OF TEST: 22/1/91
MACH NUMBER = 0.154
AIR TEMPERATURE = 26.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02623
LINEAR PITCH RATE = 292.69°S^{-1}

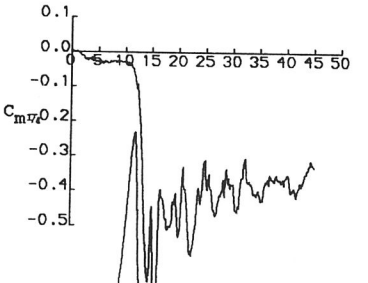


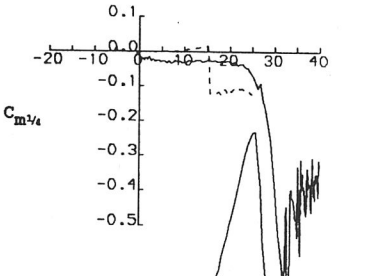


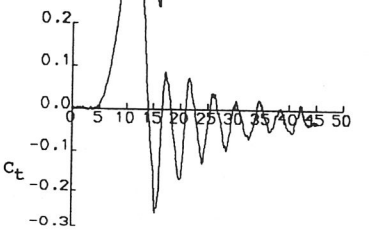


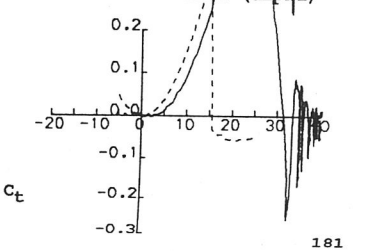








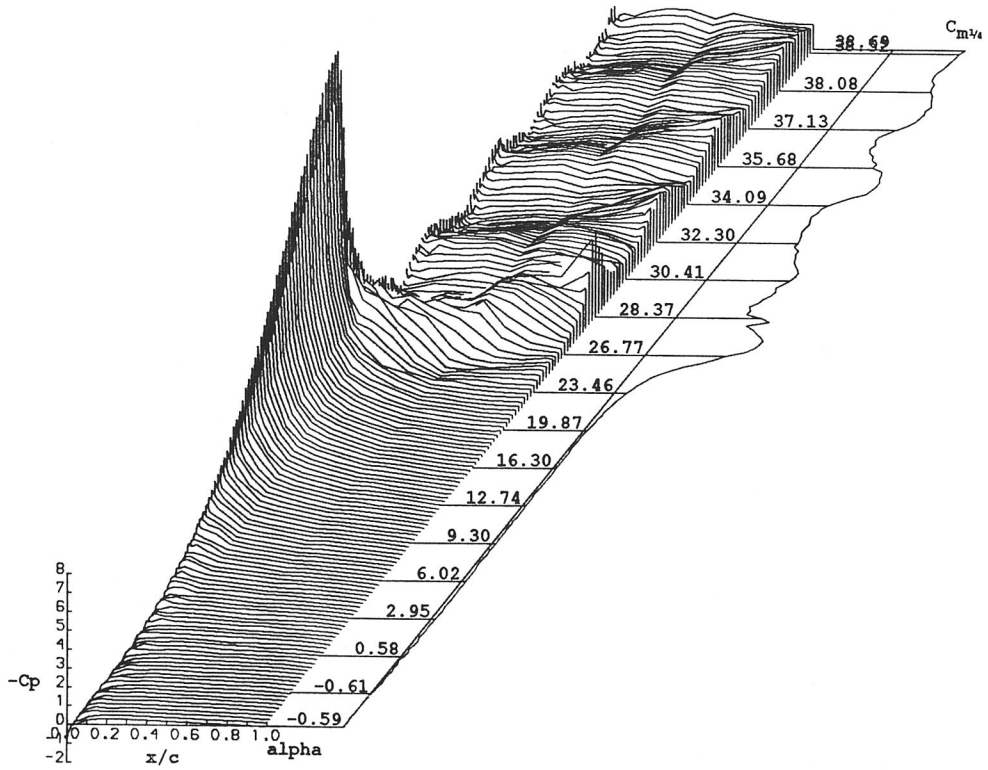


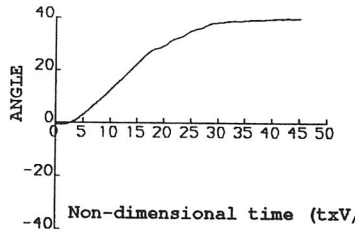


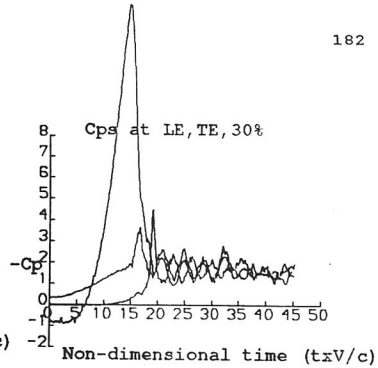
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

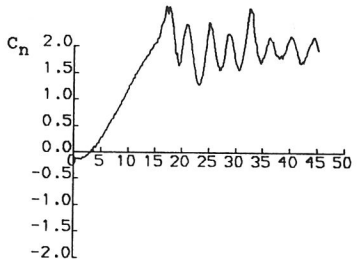
RUN REFERENCE NUMBER: 21821
REYNOLDS NUMBER = 1944520.
DYNAMIC PRESSURE = 1732.29 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

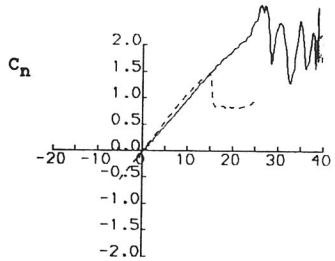
DATE OF TEST: 22/1/91
MACH NUMBER = 0.154
AIR TEMPERATURE = 28.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.01746
LINEAR PITCH RATE = 195.48°s^{-1}

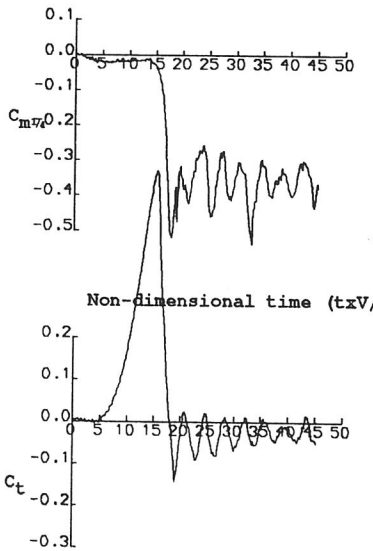


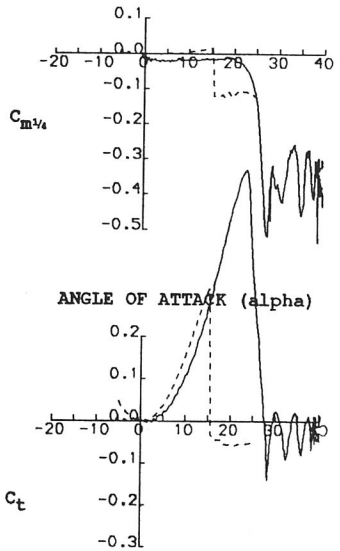








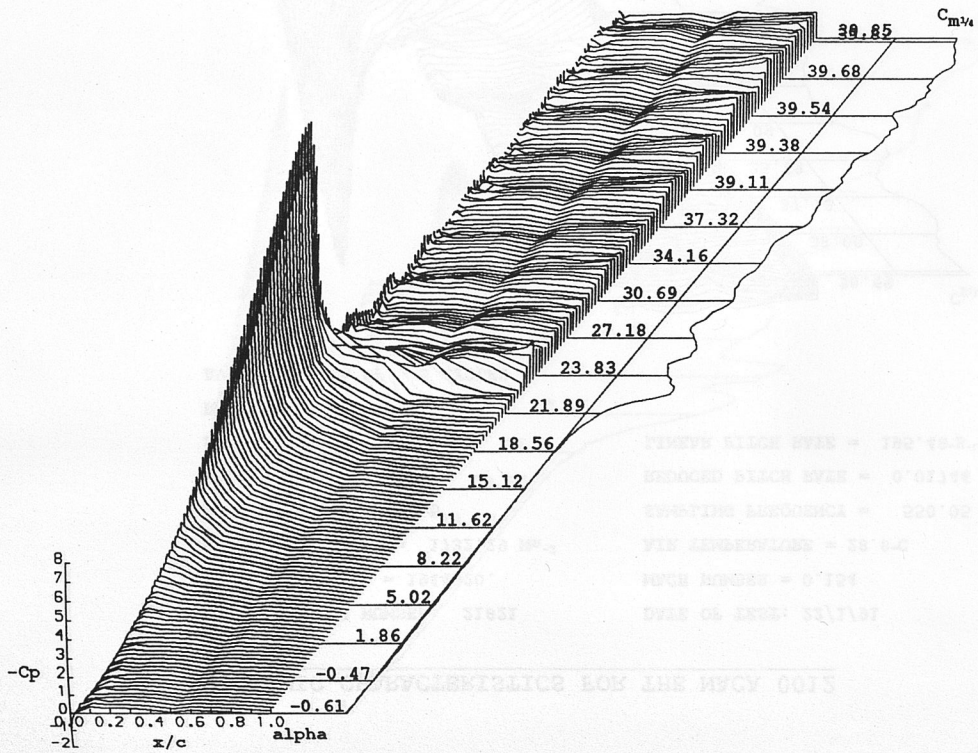


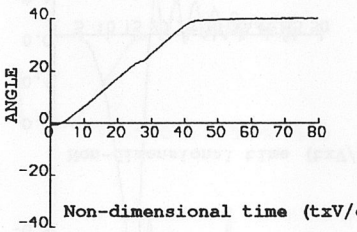


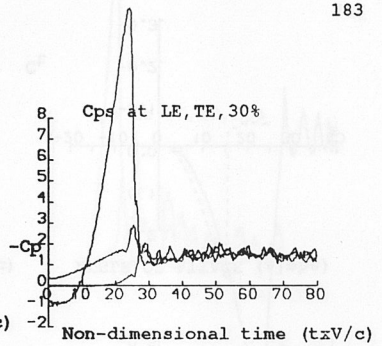
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

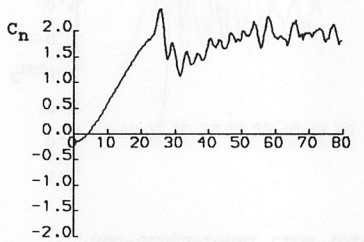
RUN REFERENCE NUMBER: 21831
REYNOLDS NUMBER = 1937950.
DYNAMIC PRESSURE = 1732.29 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

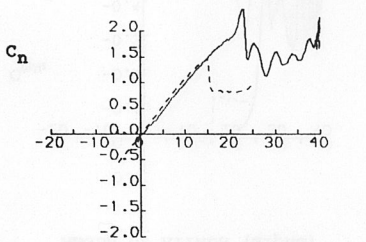
DATE OF TEST: 22/1/91
MACH NUMBER = 0.154
AIR TEMPERATURE = 29.6°C
SAMPLING FREQUENCY = 312.01 Hz.
REDUCED PITCH RATE = 0.00960
LINEAR PITCH RATE = 107.69°S^{-1}

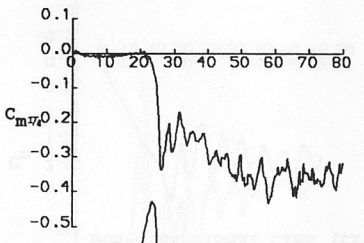


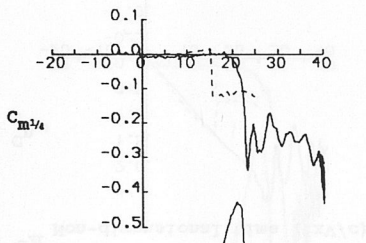


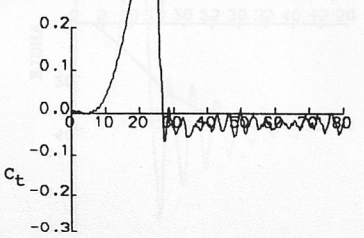


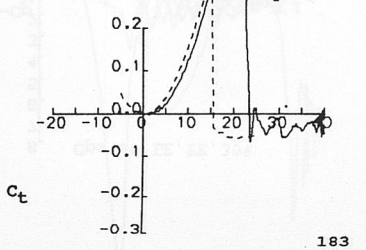








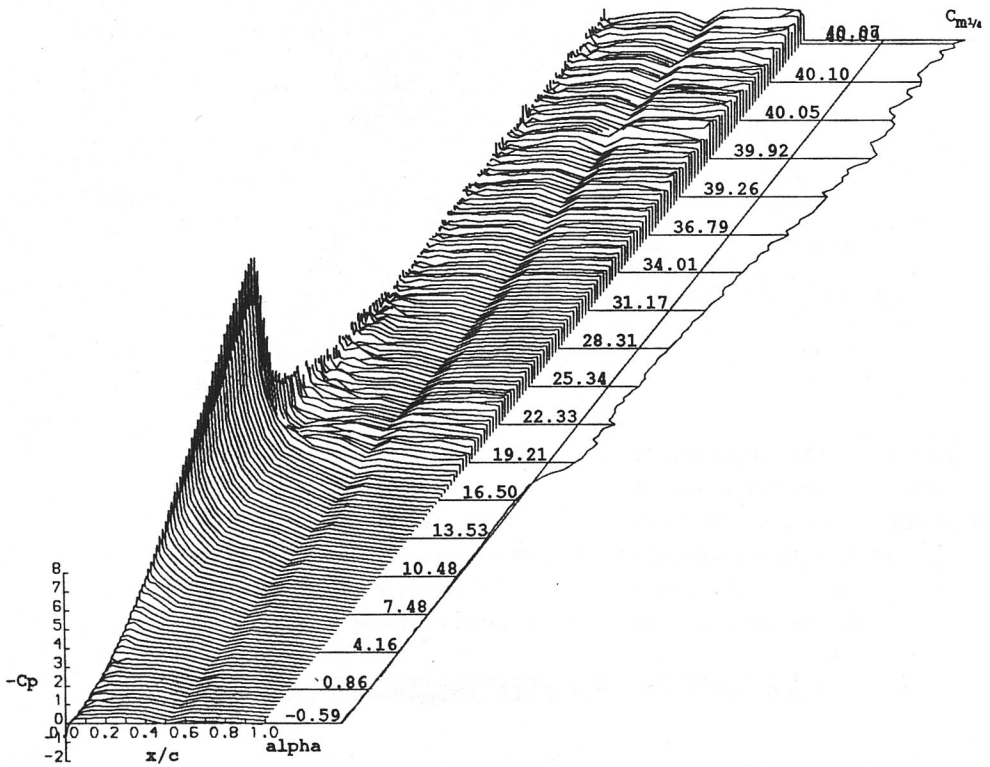


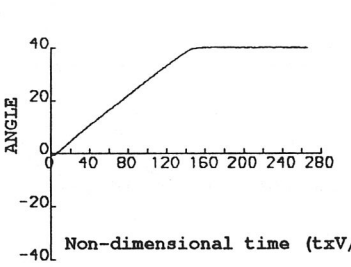


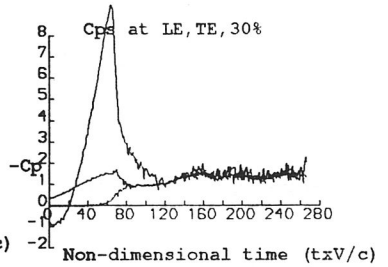
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

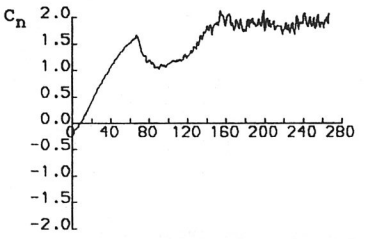
RUN REFERENCE NUMBER: 21841
REYNOLDS NUMBER = 1929798.
DYNAMIC PRESSURE = 1732.29 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

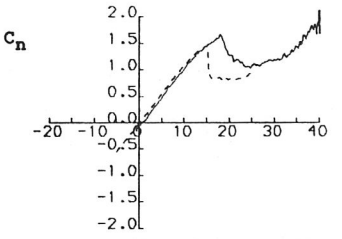
DATE OF TEST: 22/1/91
MACH NUMBER = 0.154
AIR TEMPERATURE = 30.6°C
SAMPLING FREQUENCY = 93.70 Hz.
REDUCED PITCH RATE = 0.00250
LINEAR PITCH RATE = 28.04°S^{-1}

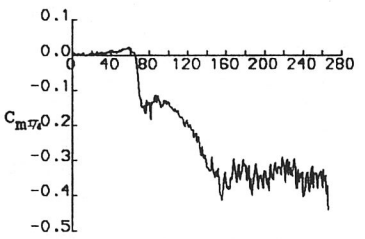


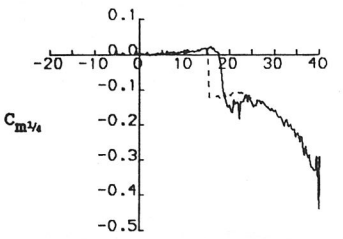


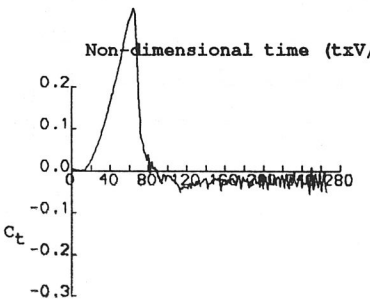


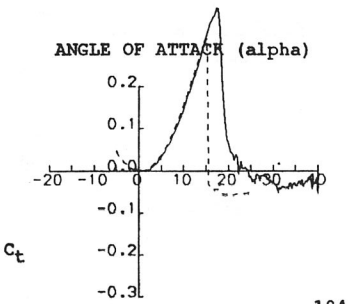








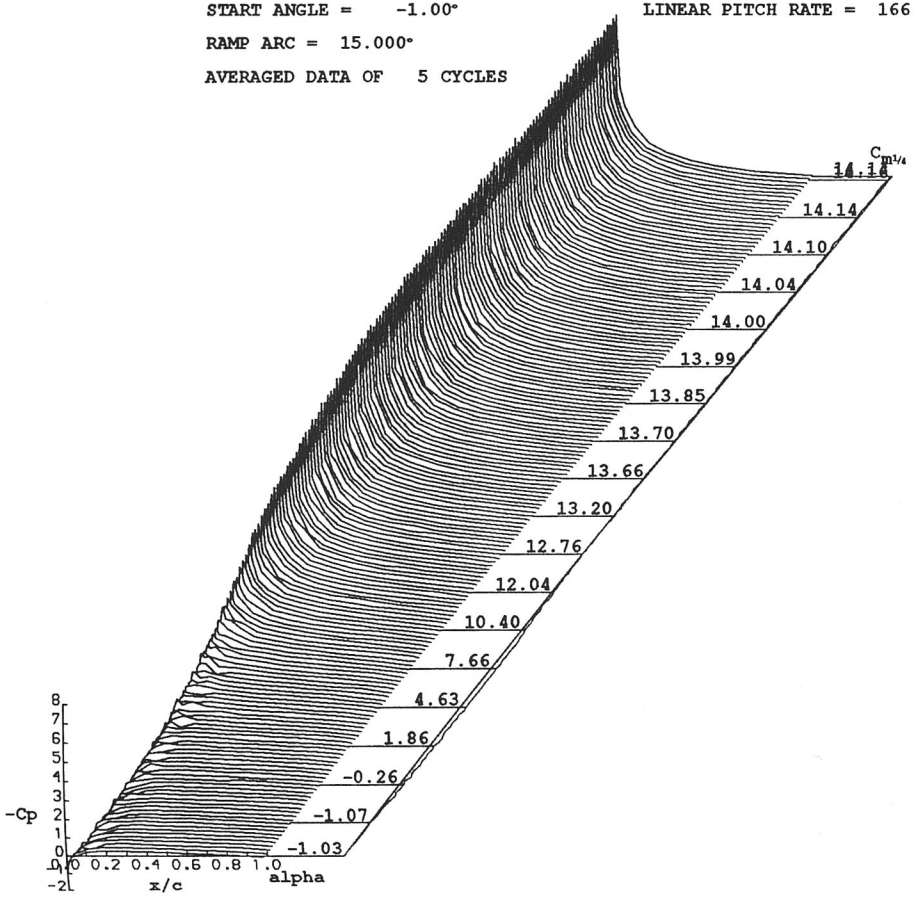


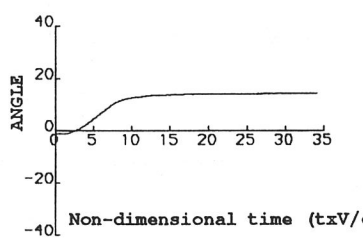


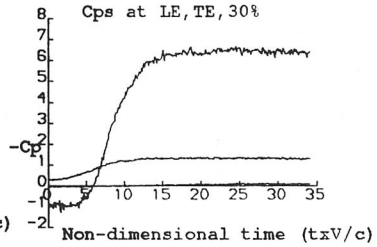
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

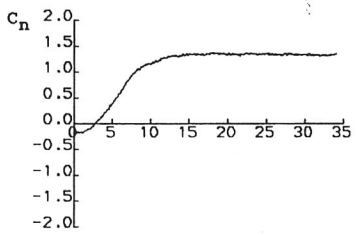
RUN REFERENCE NUMBER: 22461
REYNOLDS NUMBER = 1529679.
DYNAMIC PRESSURE = 1006.48 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 15.000°
AVERAGED DATA OF 5 CYCLES

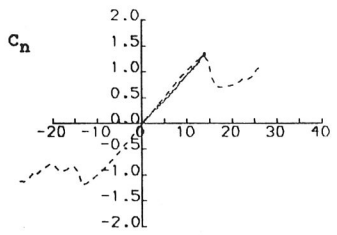
DATE OF TEST: 25/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 20.6°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.01966
LINEAR PITCH RATE = 166.11°S^{-1}

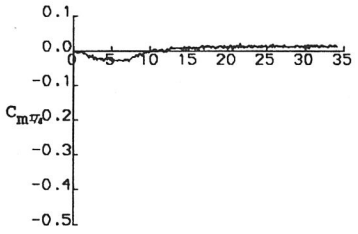


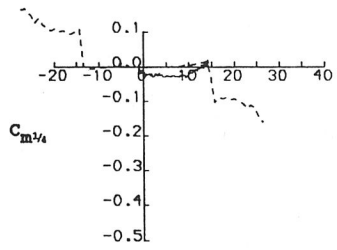


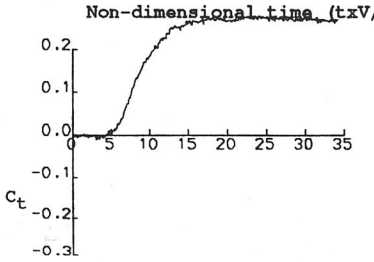


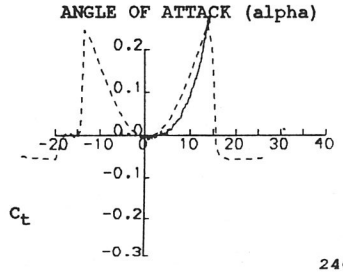








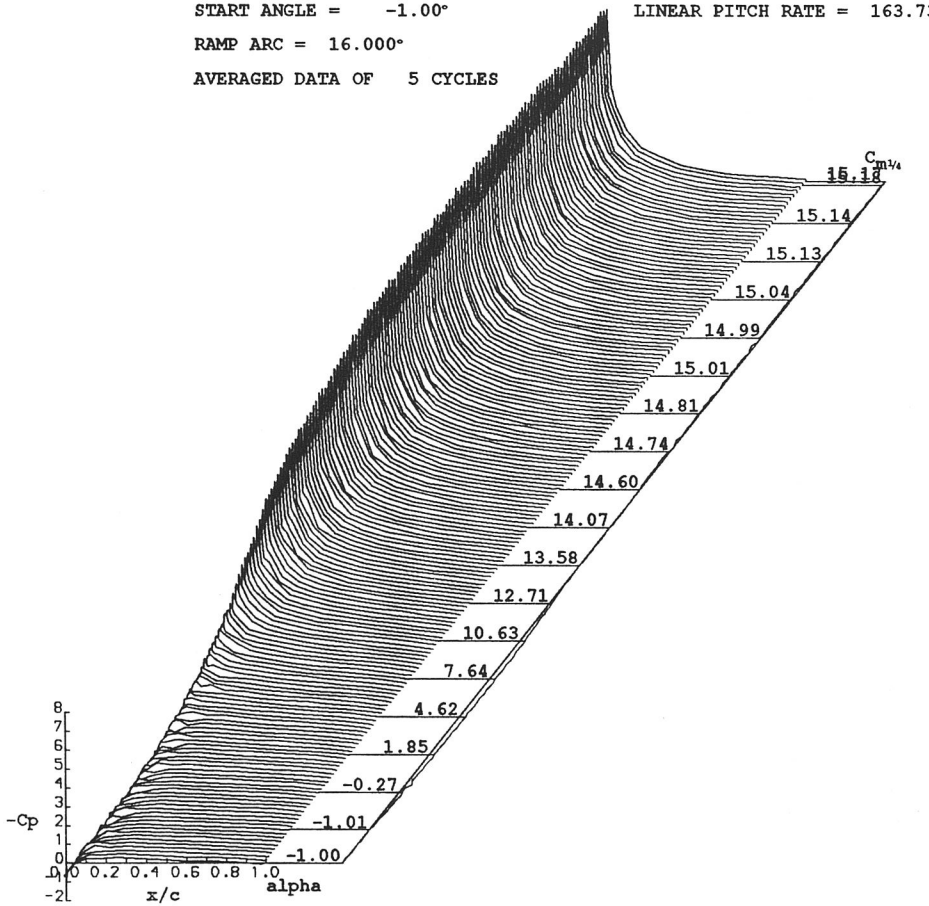


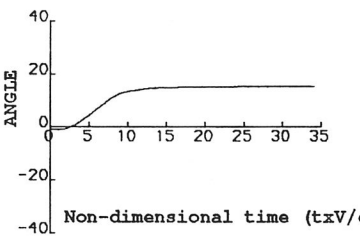


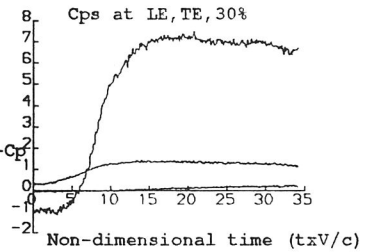
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

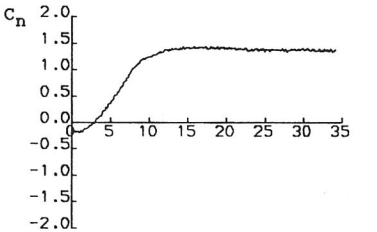
RUN REFERENCE NUMBER: 22471
REYNOLDS NUMBER = 1525009.
DYNAMIC PRESSURE = 1006.48 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 16.000°
AVERAGED DATA OF 5 CYCLES

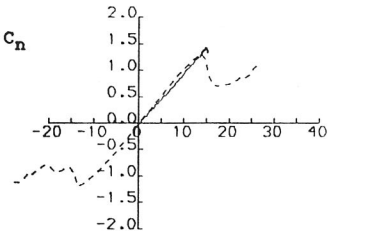
DATE OF TEST: 25/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 21.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.01935
LINEAR PITCH RATE = 163.73°S^{-1}

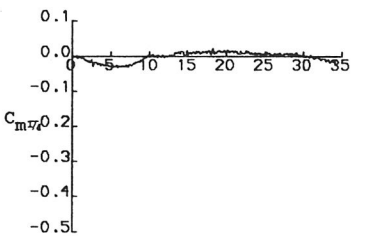


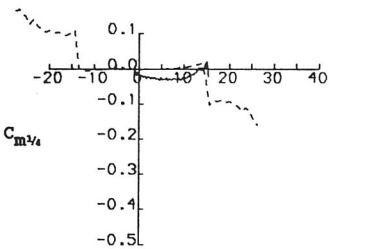


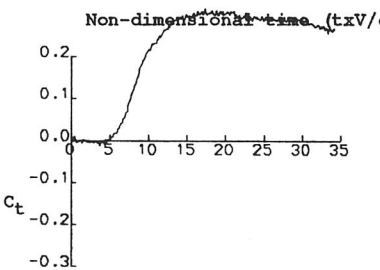


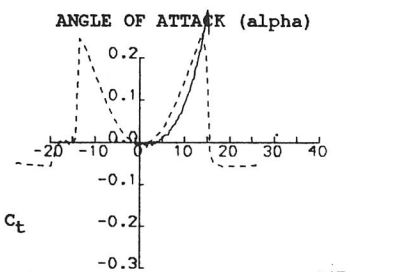








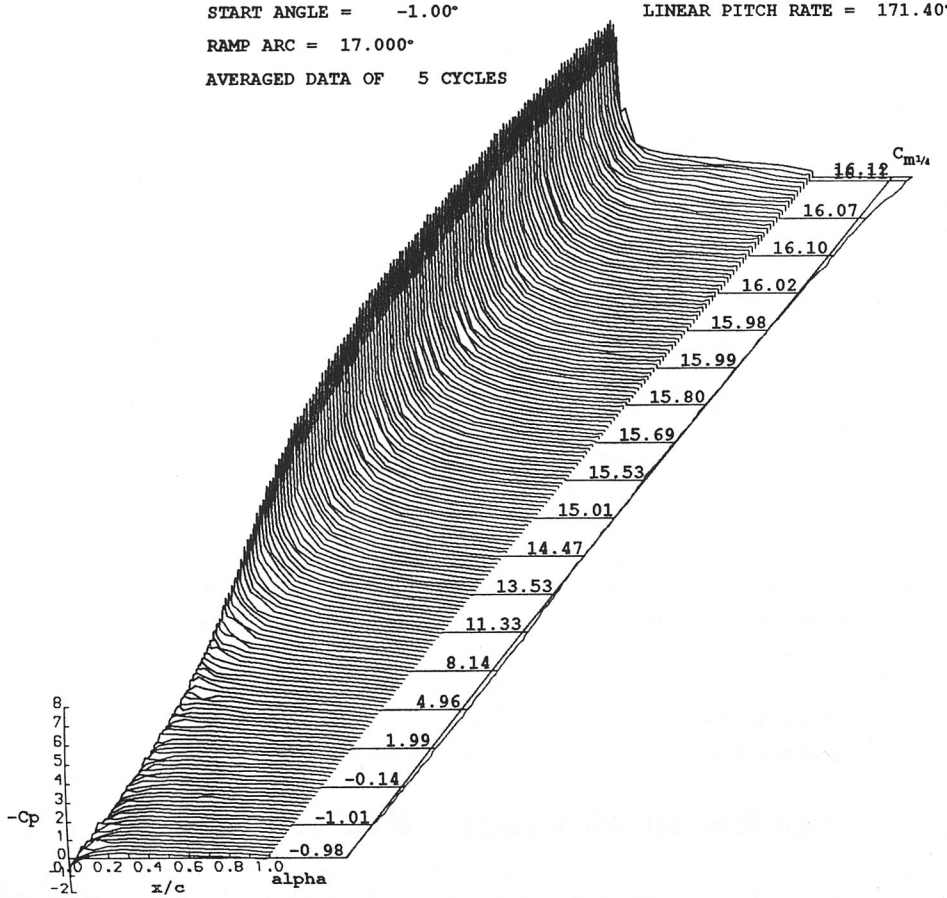


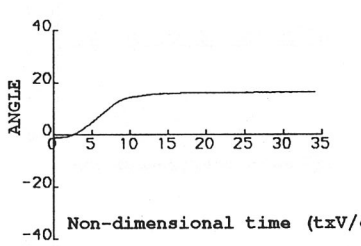


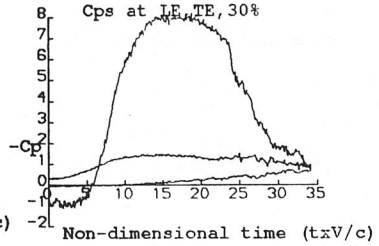
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

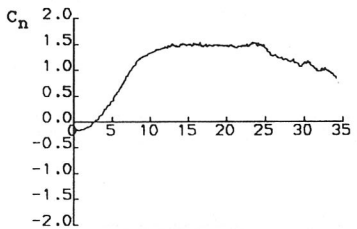
RUN REFERENCE NUMBER: 22481
REYNOLDS NUMBER = 1522352.
DYNAMIC PRESSURE = 1006.48 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 17.000°
AVERAGED DATA OF 5 CYCLES

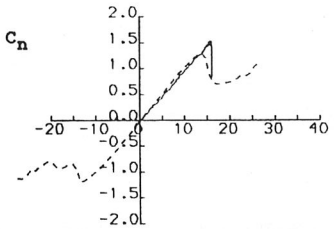
DATE OF TEST: 25/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 21.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02025
LINEAR PITCH RATE = 171.40°S^{-1}

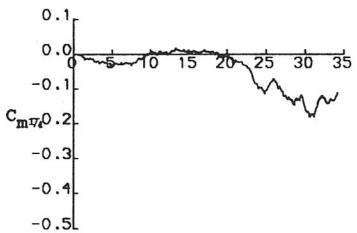


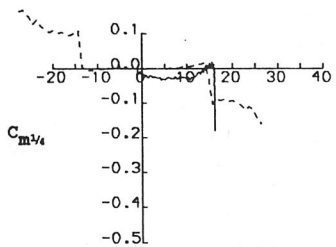


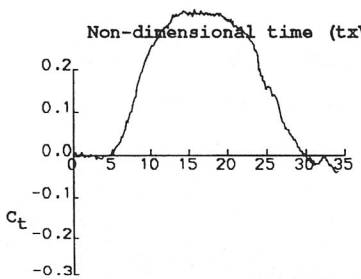


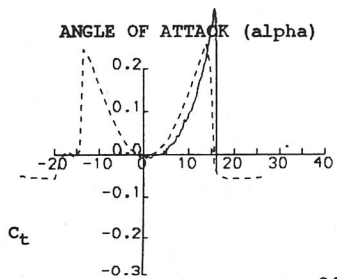






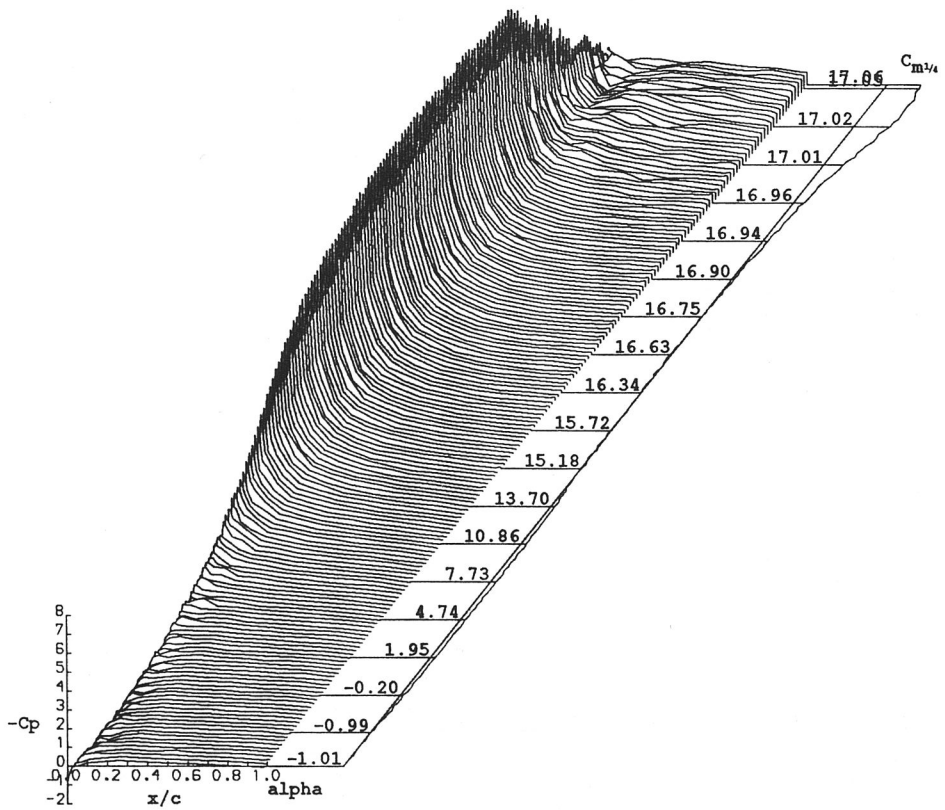


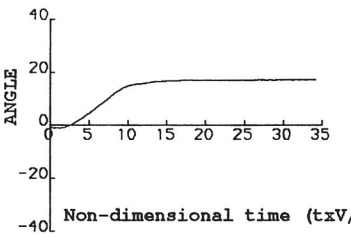


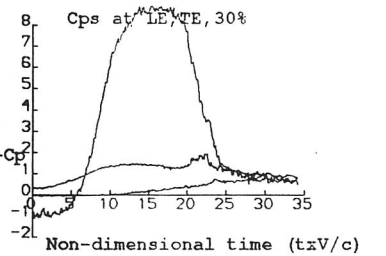


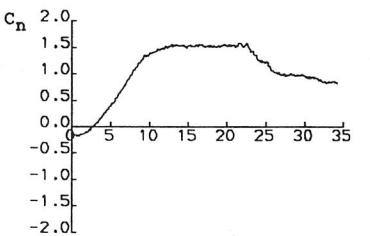
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

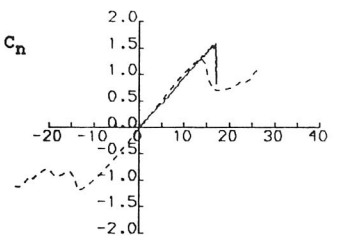
RUN REFERENCE NUMBER: 22491
DATE OF TEST: 25/1/91
REYNOLDS NUMBER = 1521028.
MACH NUMBER = 0.118
DYNAMIC PRESSURE = 1006.48 Nm^{-2}
AIR TEMPERATURE = 21.9°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 550.05 Hz.
MOTION TYPE: RAMP UP
REDUCED PITCH RATE = 0.01924
START ANGLE = -1.00°
LINEAR PITCH RATE = 162.96°S^{-1}
RAMP ARC = 18.000°
AVERAGED DATA OF 5 CYCLES

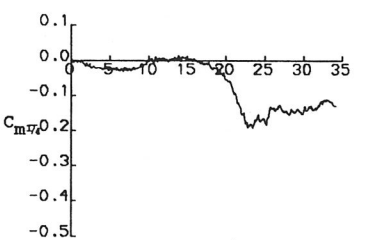


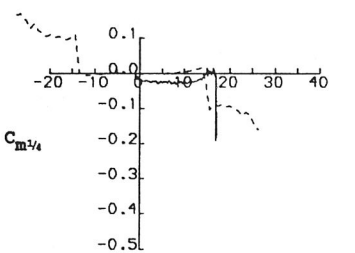


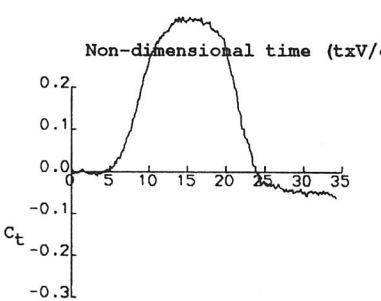


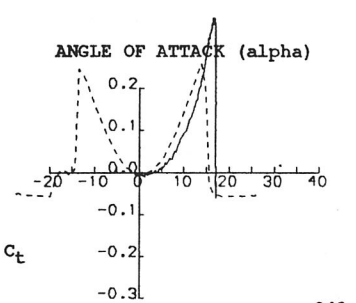








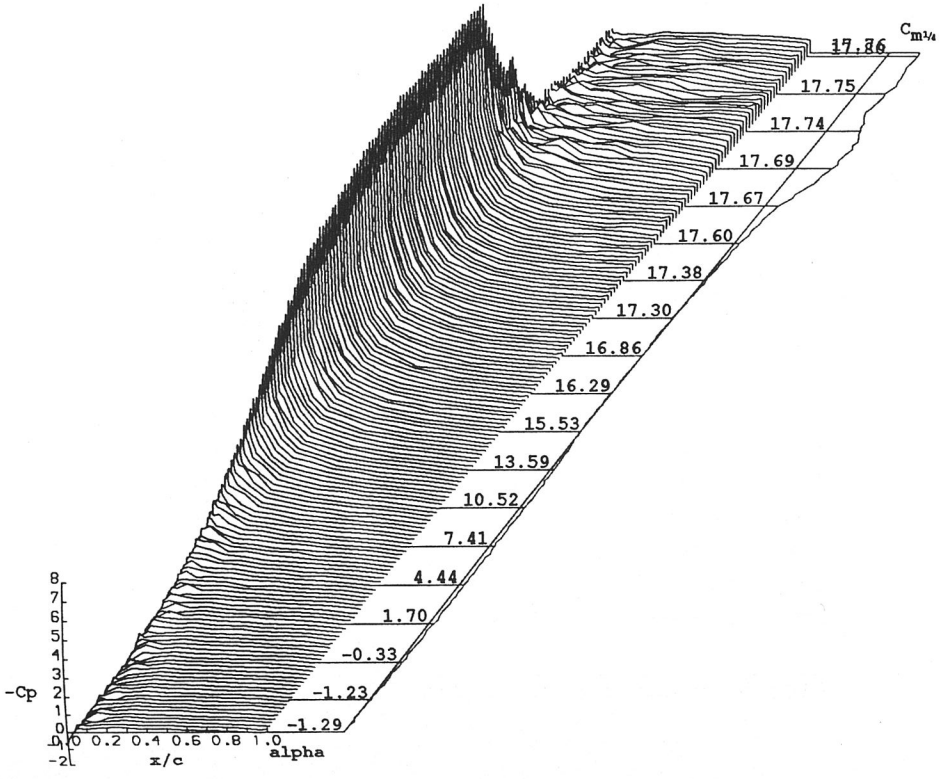


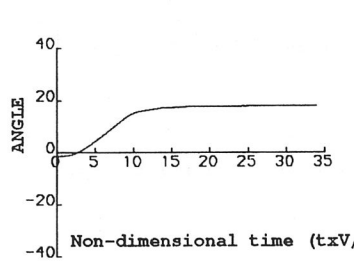


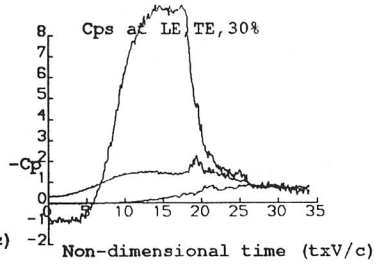
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

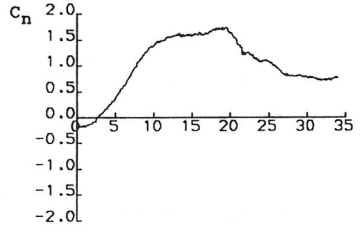
RUN REFERENCE NUMBER: 22501
REYNOLDS NUMBER = 1473251.
DYNAMIC PRESSURE = 979.95 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 19.000°
AVERAGED DATA OF 5 CYCLES

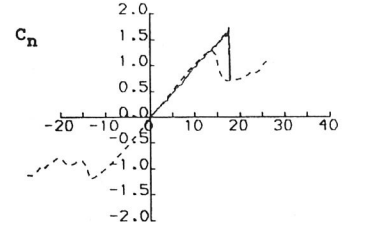
DATE OF TEST: 25/1/91
MACH NUMBER = 0.116
AIR TEMPERATURE = 26.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.01923
LINEAR PITCH RATE = 161.89°S^{-1}

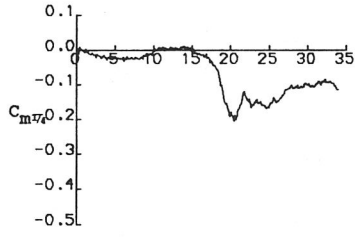


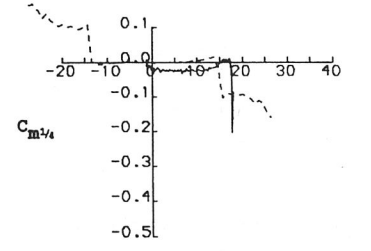


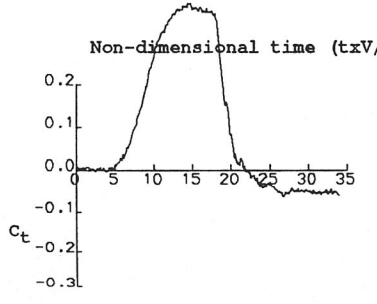


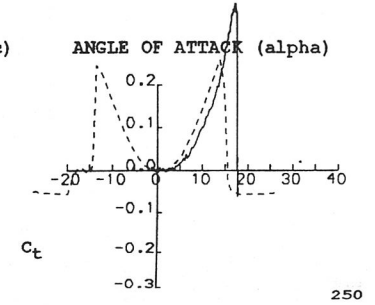








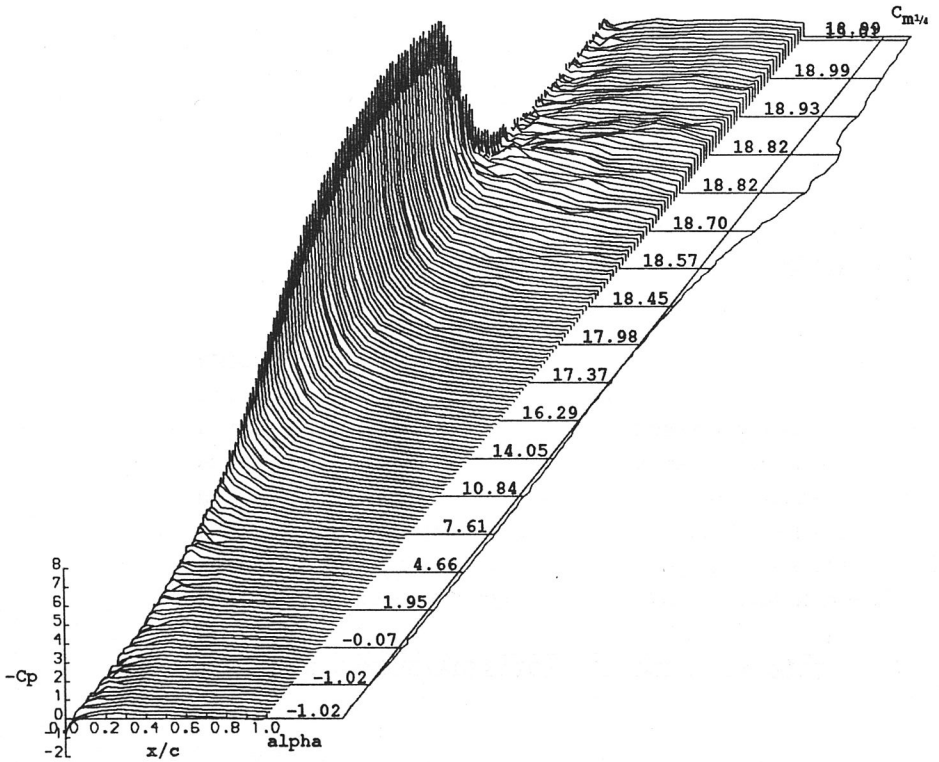


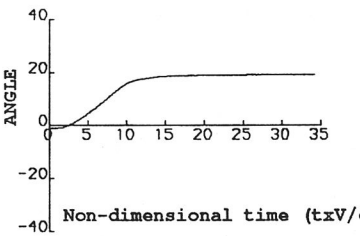


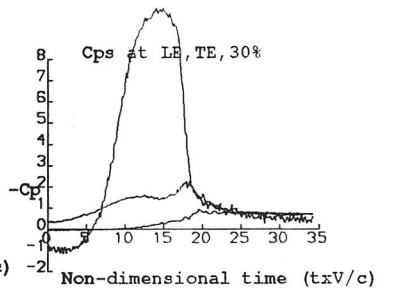
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

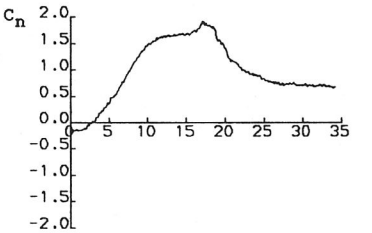
RUN REFERENCE NUMBER: 22511
REYNOLDS NUMBER = 1516408.
DYNAMIC PRESSURE = 1006.48 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 20.000°
AVERAGED DATA OF 5 CYCLES

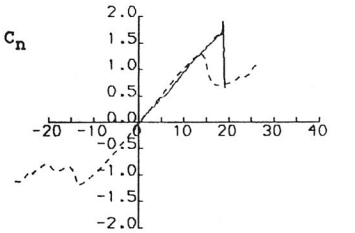
DATE OF TEST: 25/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 22.6°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.01935
LINEAR PITCH RATE = 164.06°S^{-1}

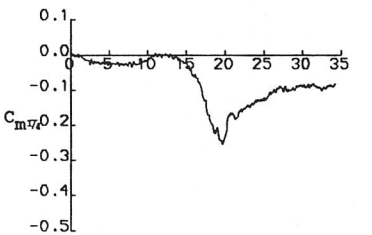


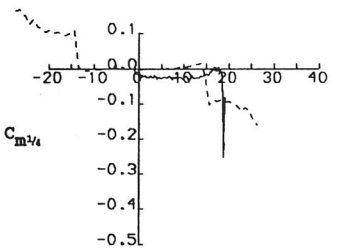


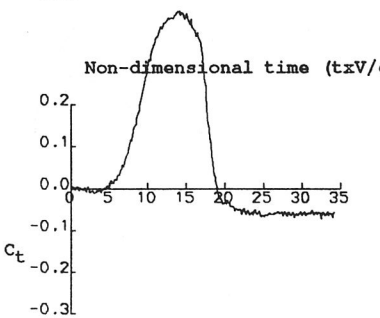


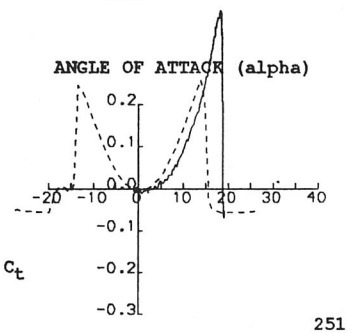








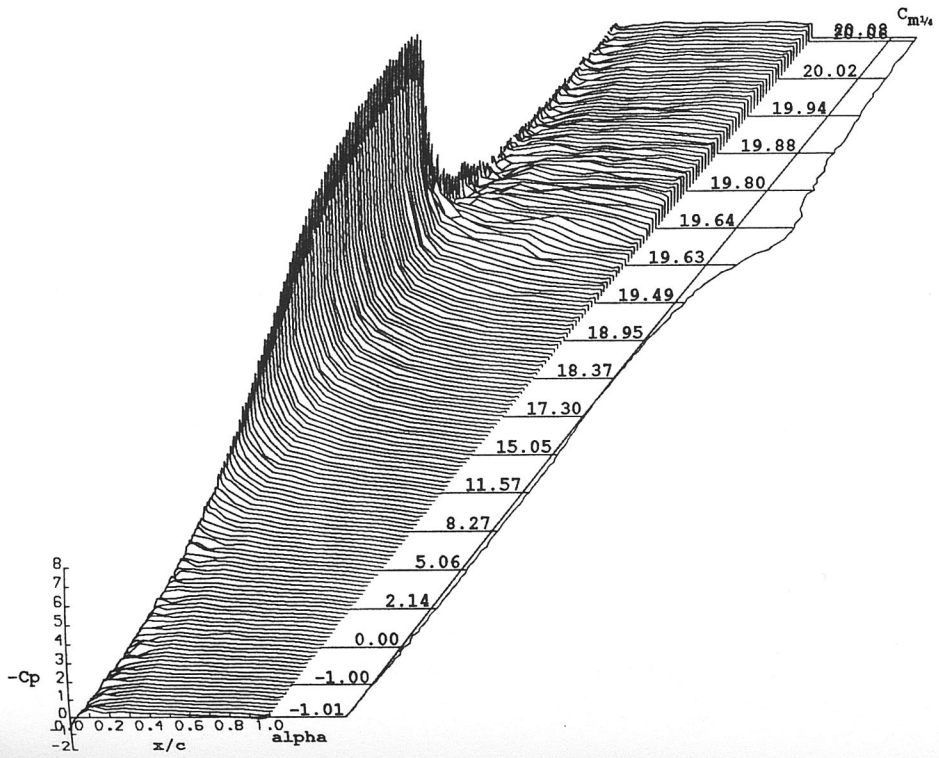


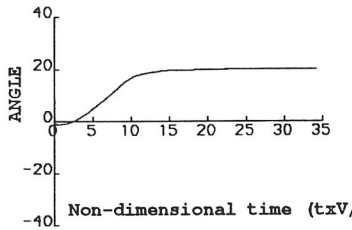


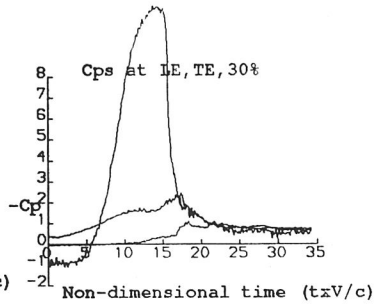
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

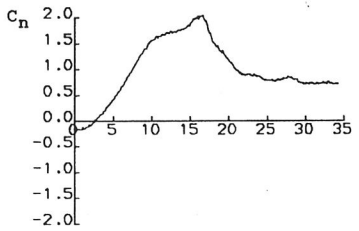
RUN REFERENCE NUMBER: 22521
REYNOLDS NUMBER = 1514436.
DYNAMIC PRESSURE = 1006.48 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 21.000°
AVERAGED DATA OF 5 CYCLES

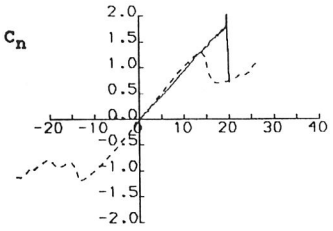
DATE OF TEST: 25/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 22.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02078
LINEAR PITCH RATE = 176.25°S^{-1}

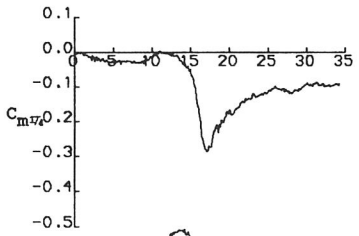


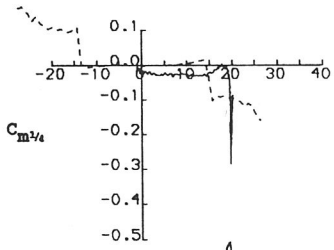


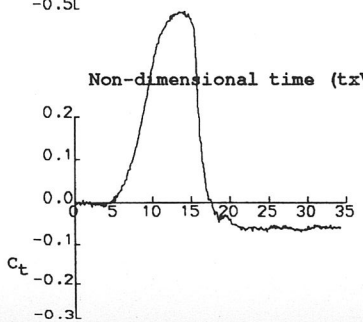


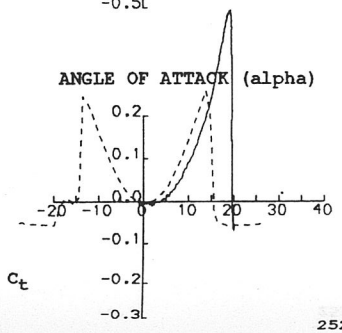








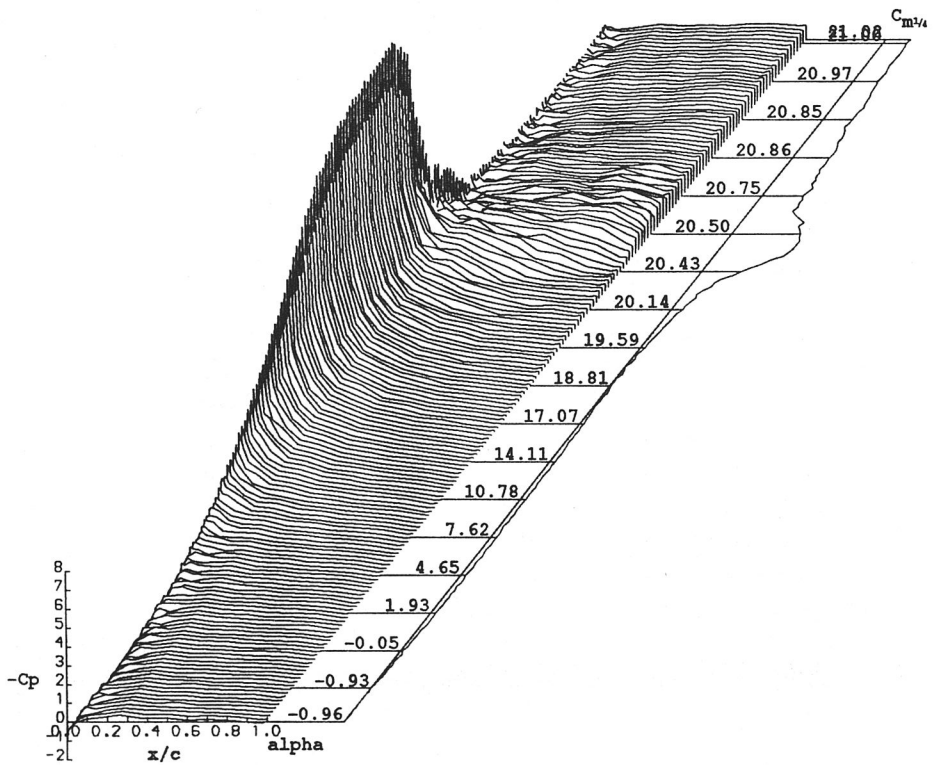


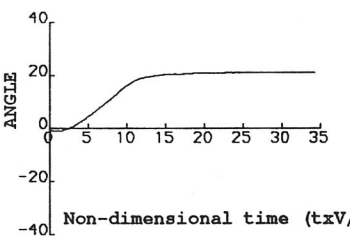


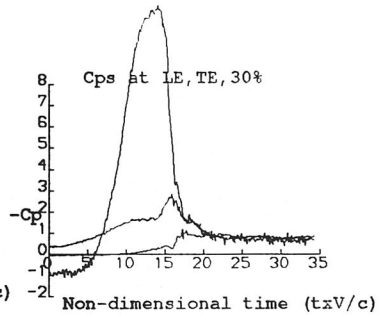
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

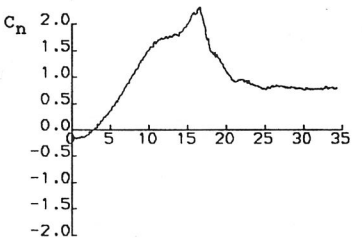
RUN REFERENCE NUMBER: 22531
REYNOLDS NUMBER = 1511814.
DYNAMIC PRESSURE = 1006.48 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 22.000°
AVERAGED DATA OF 5 CYCLES

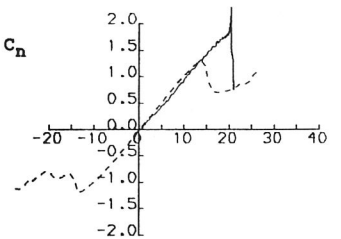
DATE OF TEST: 25/1/91
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.01955
LINEAR PITCH RATE = 165.92°S^{-1}

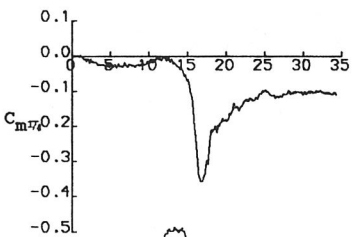


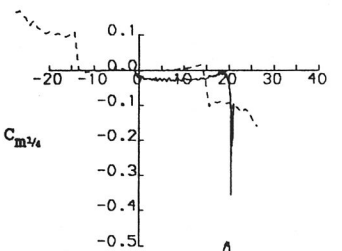


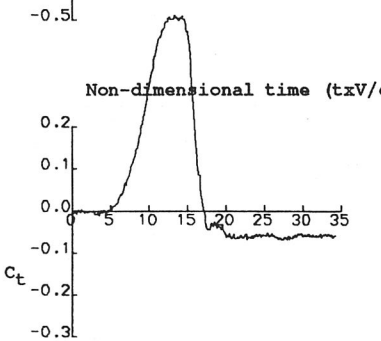


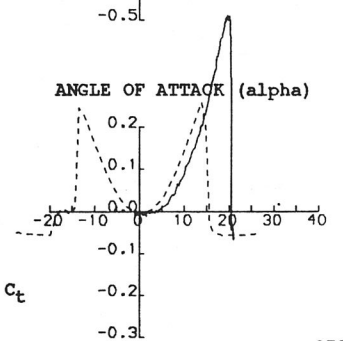








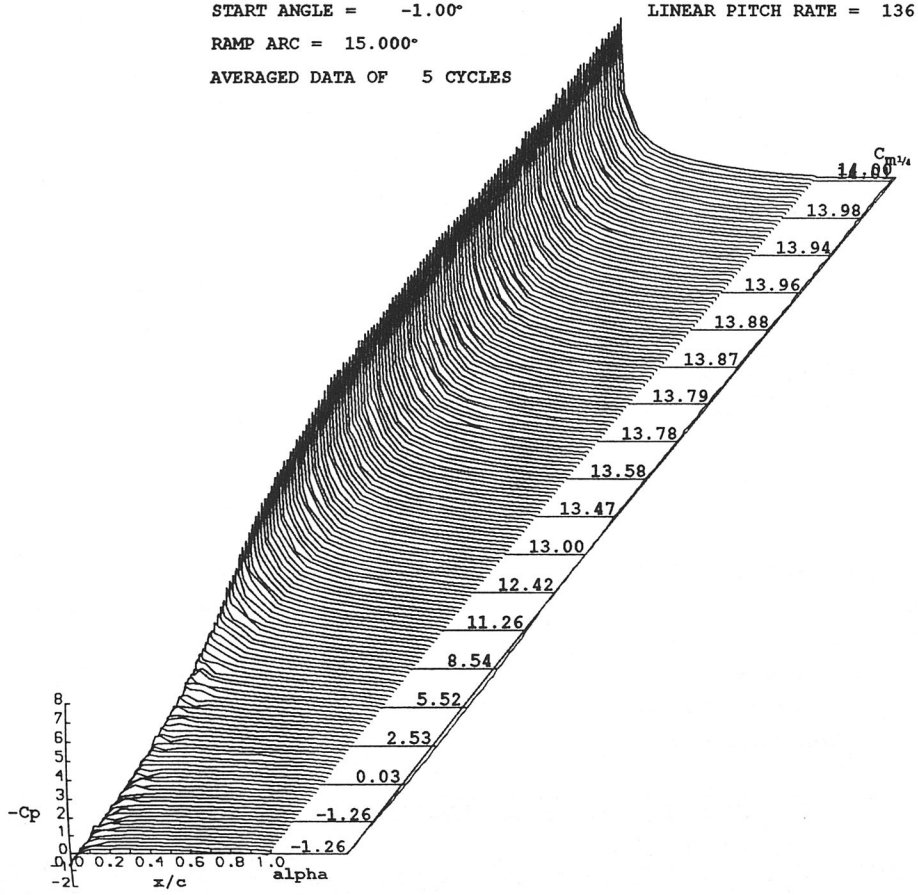


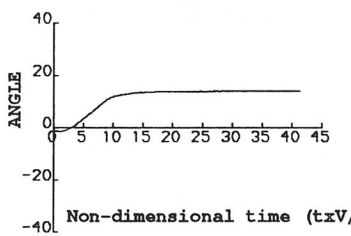


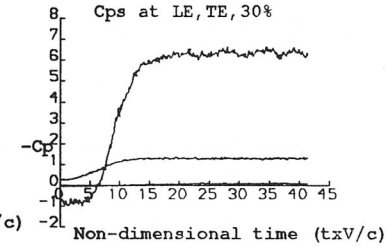
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

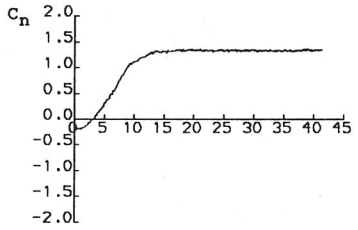
RUN REFERENCE NUMBER: 22541
REYNOLDS NUMBER = 1485324.
DYNAMIC PRESSURE = 979.95 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 15.000°
AVERAGED DATA OF 5 CYCLES

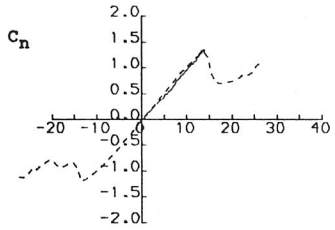
DATE OF TEST: 25/1/91
MACH NUMBER = 0.116
AIR TEMPERATURE = 24.3°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01626
LINEAR PITCH RATE = 136.44°S^{-1}

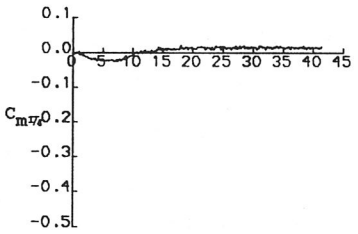


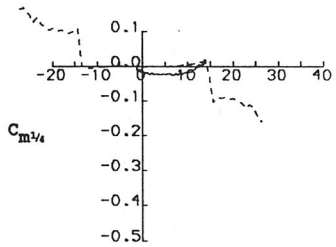


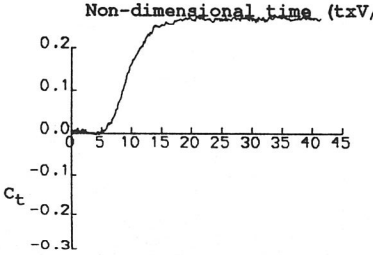


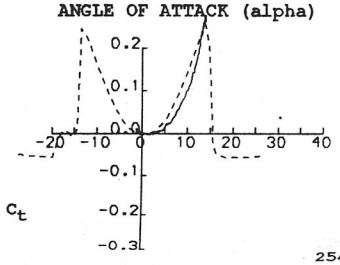








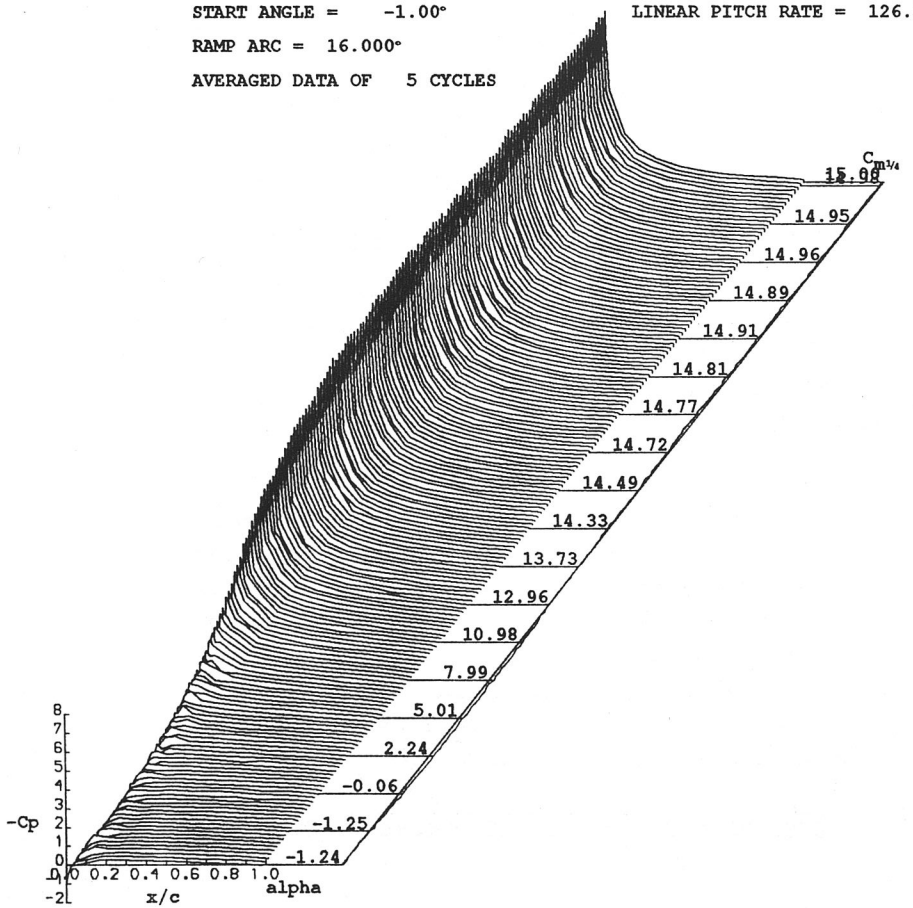


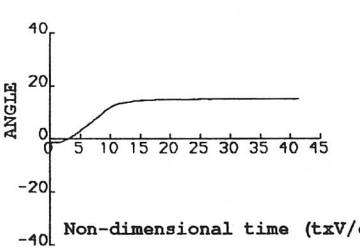


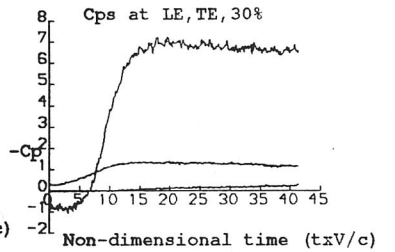
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

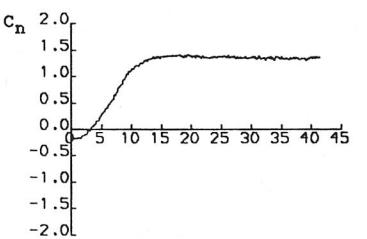
RUN REFERENCE NUMBER: 22551
REYNOLDS NUMBER = 1483405.
DYNAMIC PRESSURE = 979.95 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 16.000°
AVERAGED DATA OF 5 CYCLES

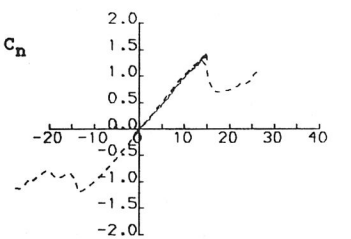
DATE OF TEST: 25/1/91
MACH NUMBER = 0.116
AIR TEMPERATURE = 24.6°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01511
LINEAR PITCH RATE = 126.85°S^{-1}

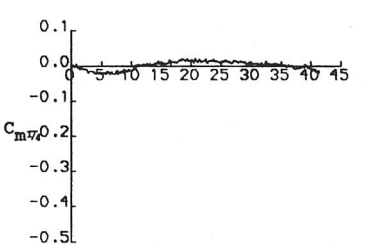


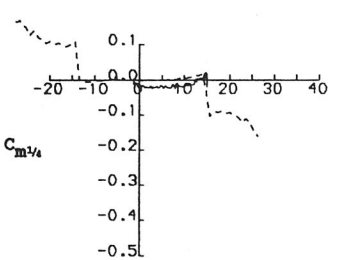


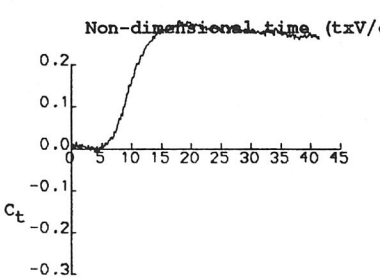


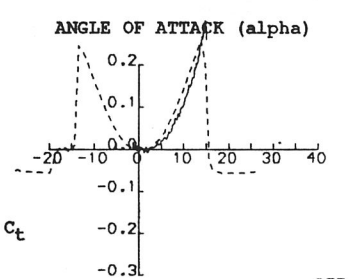








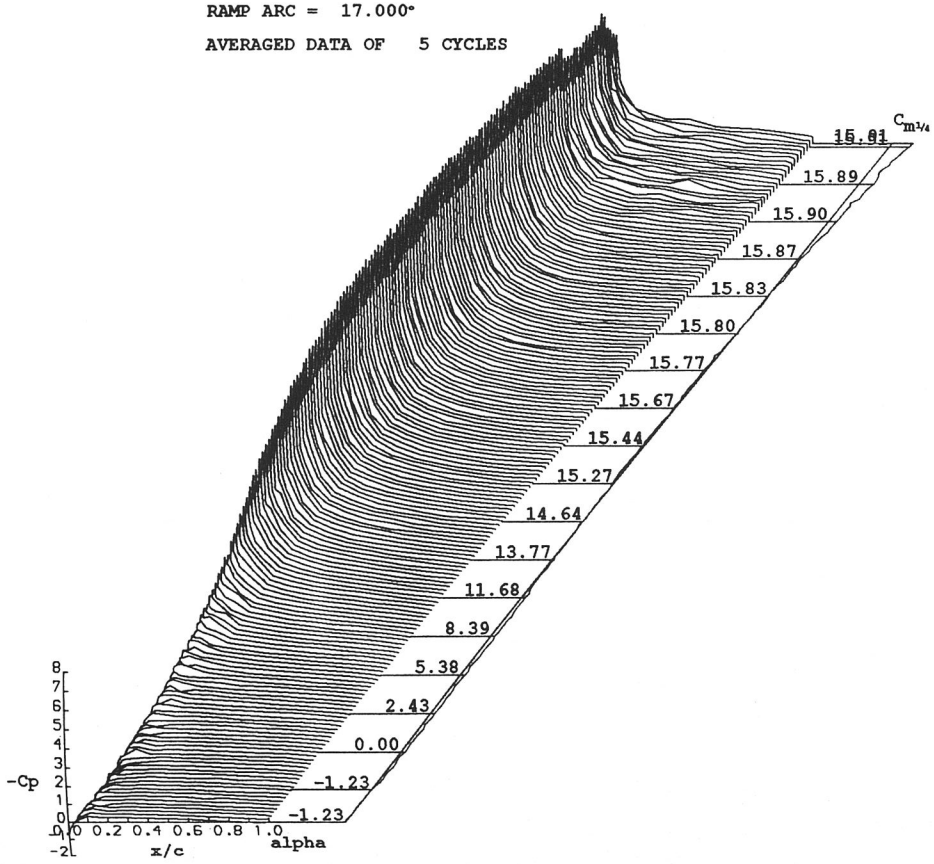


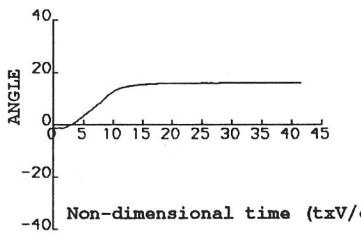


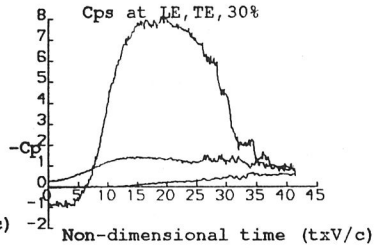
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

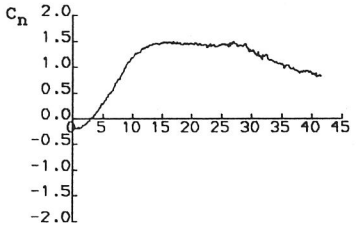
RUN REFERENCE NUMBER: 22561
REYNOLDS NUMBER = 1482129.
DYNAMIC PRESSURE = 979.95 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 17.000°
AVERAGED DATA OF 5 CYCLES

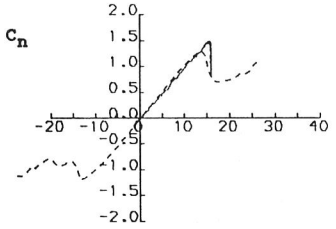
DATE OF TEST: 25/1/91
MACH NUMBER = 0.116
AIR TEMPERATURE = 24.8°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01601
LINEAR PITCH RATE = 134.42°S^{-1}

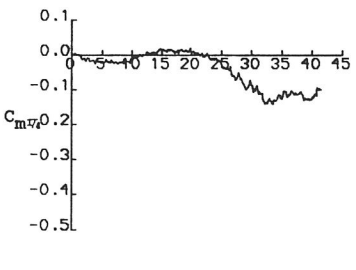


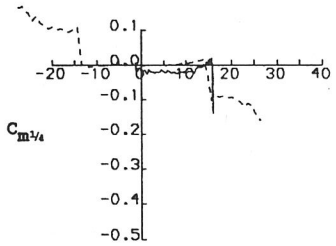


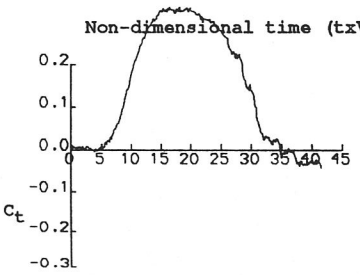


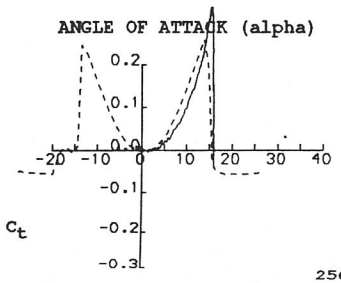








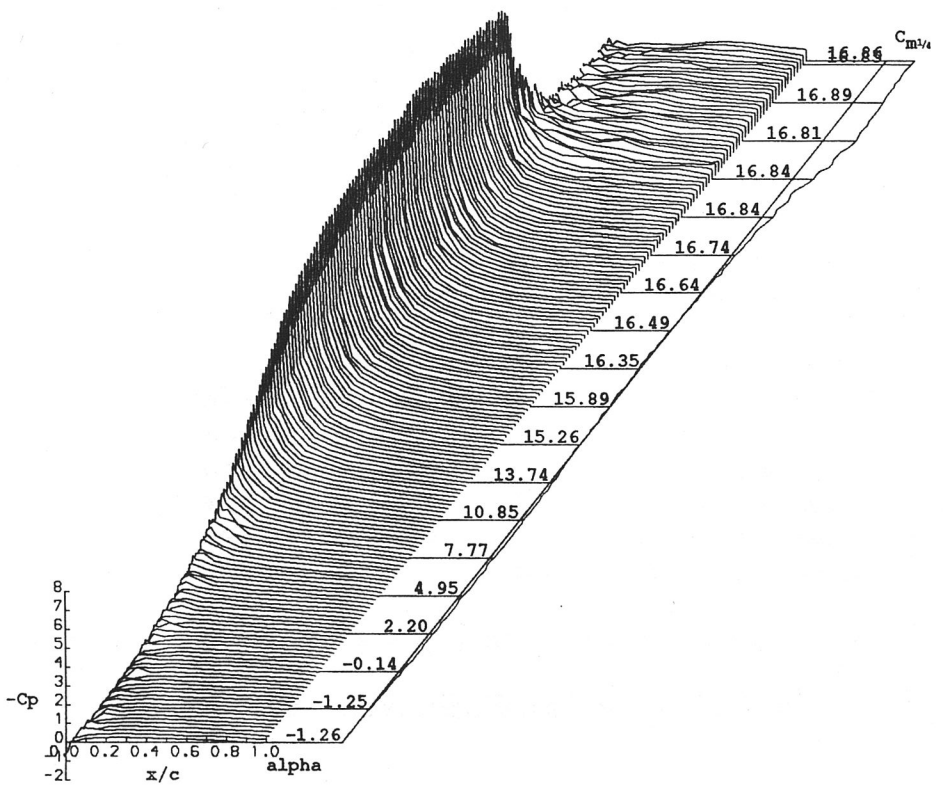


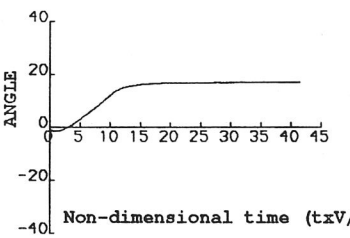


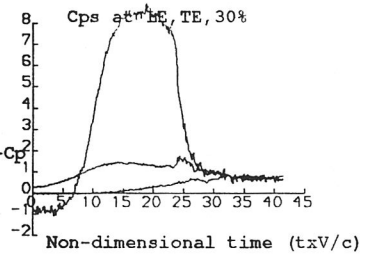
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

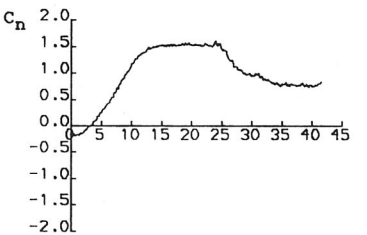
RUN REFERENCE NUMBER: 22571
REYNOLDS NUMBER = 1480218.
DYNAMIC PRESSURE = 979.95 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 18.000°
AVERAGED DATA OF 5 CYCLES

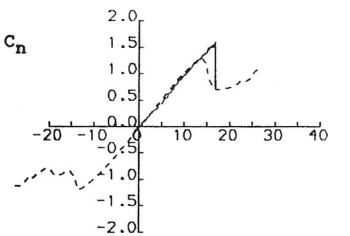
DATE OF TEST: 25/1/91
MACH NUMBER = 0.116
AIR TEMPERATURE = 25.1°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01489
LINEAR PITCH RATE = 125.11°S^{-1}

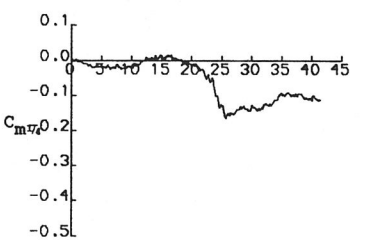


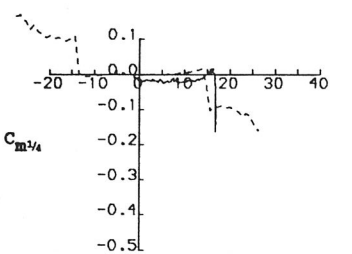


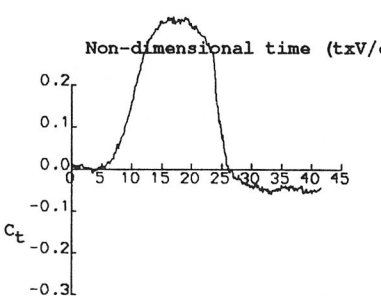


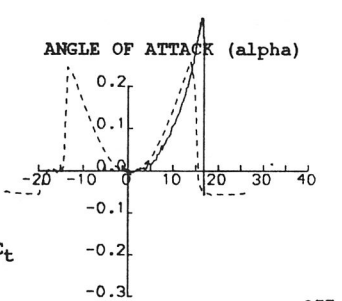








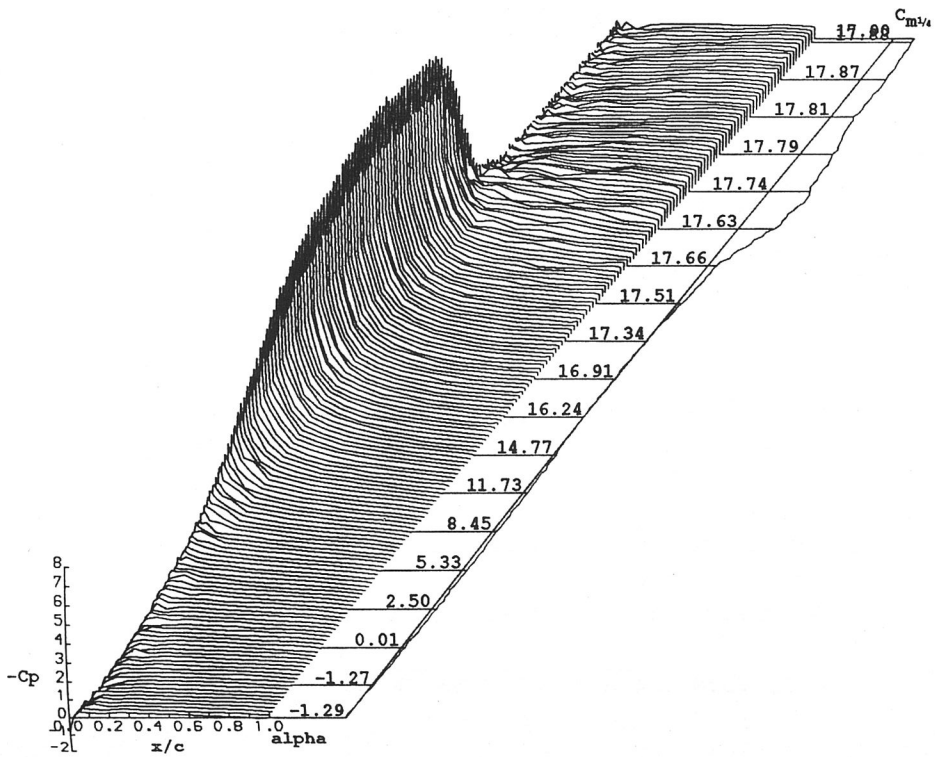


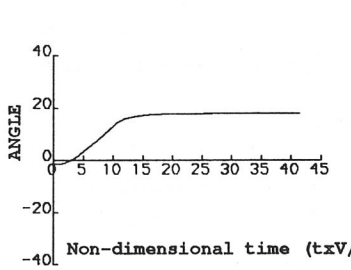


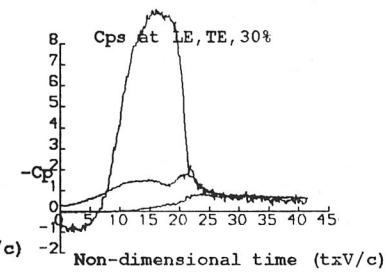
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

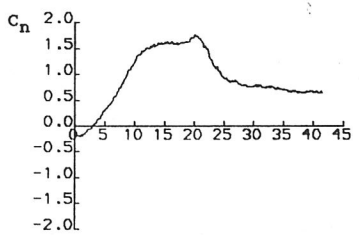
RUN REFERENCE NUMBER: 22581
REYNOLDS NUMBER = 1478312.
DYNAMIC PRESSURE = 979.95 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 19.000°
AVERAGED DATA OF 5 CYCLES

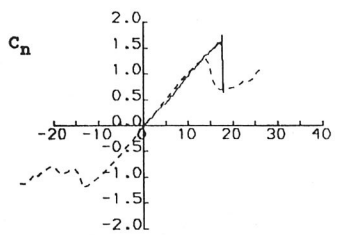
DATE OF TEST: 25/1/91
MACH NUMBER = 0.116
AIR TEMPERATURE = 25.4°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01598
LINEAR PITCH RATE = 134.29°S^{-1}

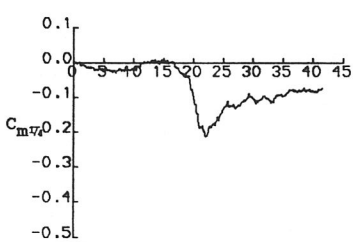


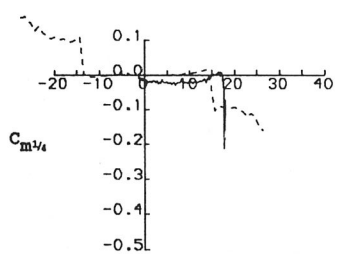


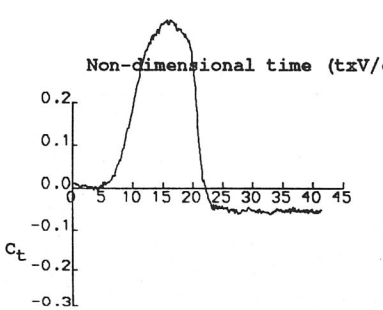


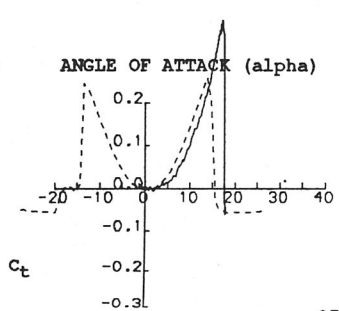








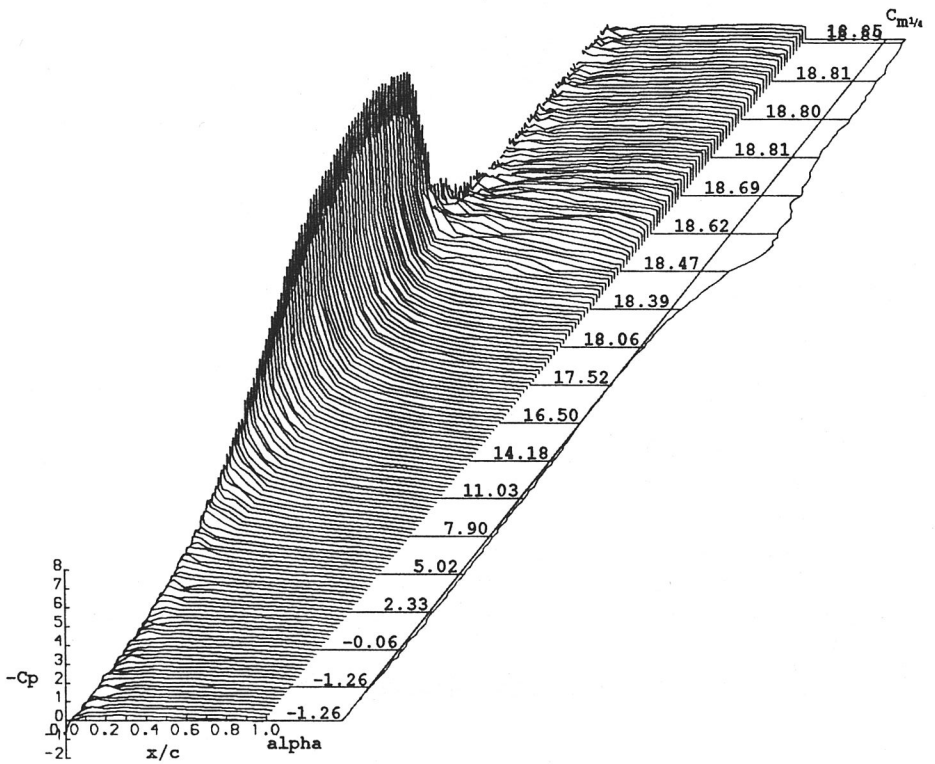


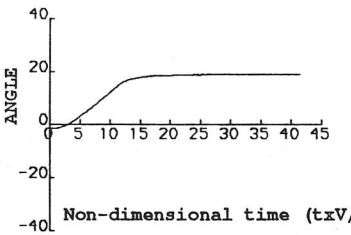


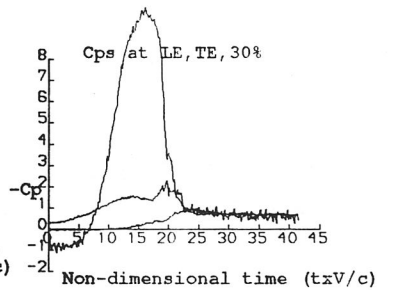
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

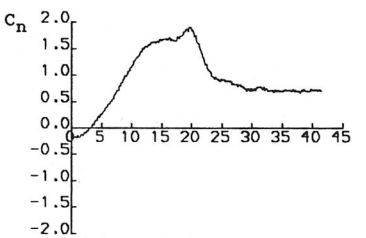
RUN REFERENCE NUMBER: 22591
REYNOLDS NUMBER = 1477043.
DYNAMIC PRESSURE = 979.95 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 20.000°
AVERAGED DATA OF 5 CYCLES

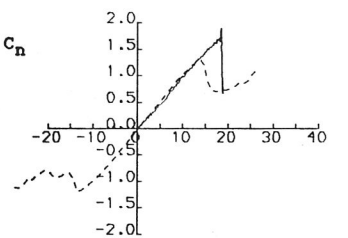
DATE OF TEST: 25/1/91
MACH NUMBER = 0.116
AIR TEMPERATURE = 25.6°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01544
LINEAR PITCH RATE = 129.82°S^{-1}

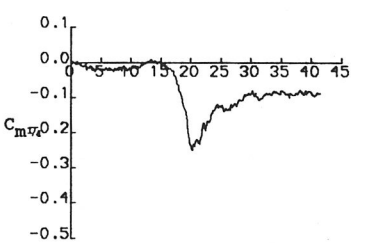


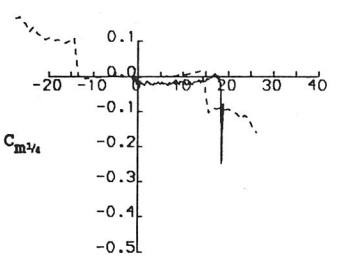


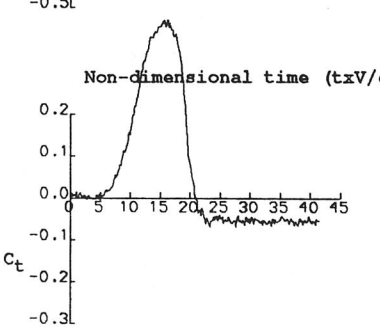


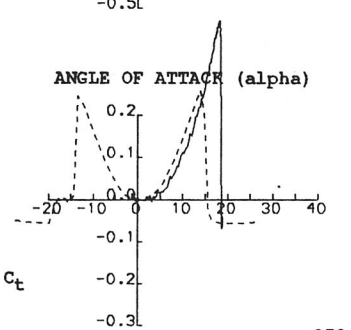








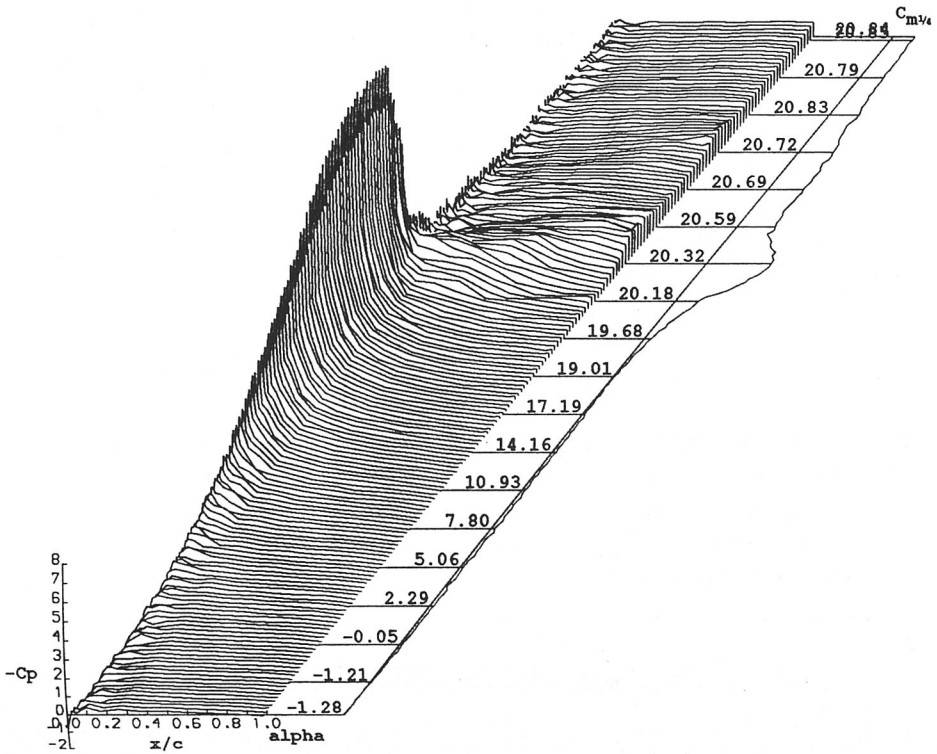


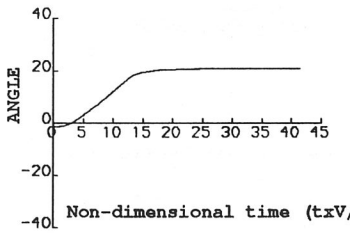


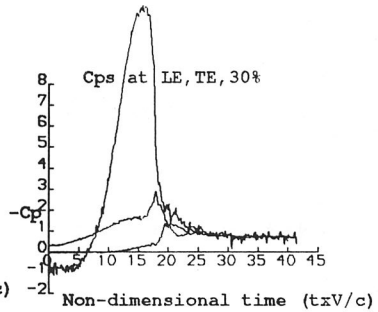
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

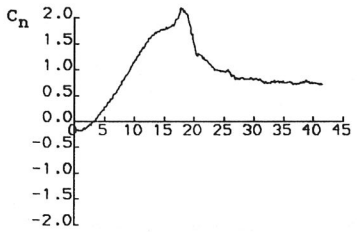
RUN REFERENCE NUMBER: 22601
REYNOLDS NUMBER = 1473882.
DYNAMIC PRESSURE = 979.95 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 22.000°
AVERAGED DATA OF 5 CYCLES

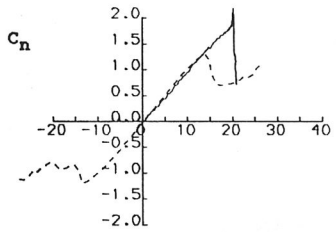
DATE OF TEST: 25/1/91
MACH NUMBER = 0.116
AIR TEMPERATURE = 26.1°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01601
LINEAR PITCH RATE = 134.76°S^{-1}

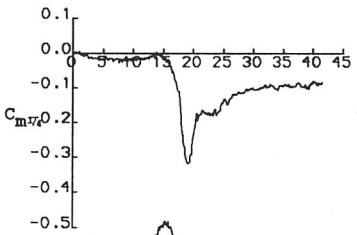


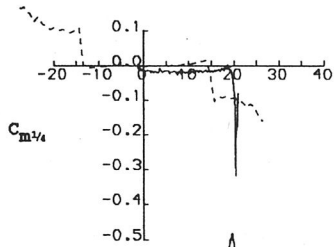


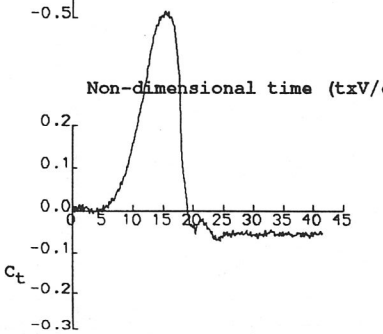


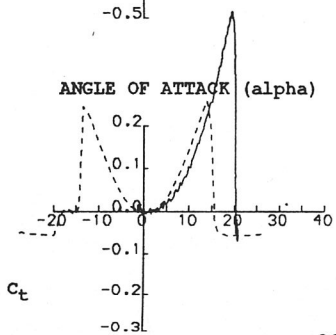






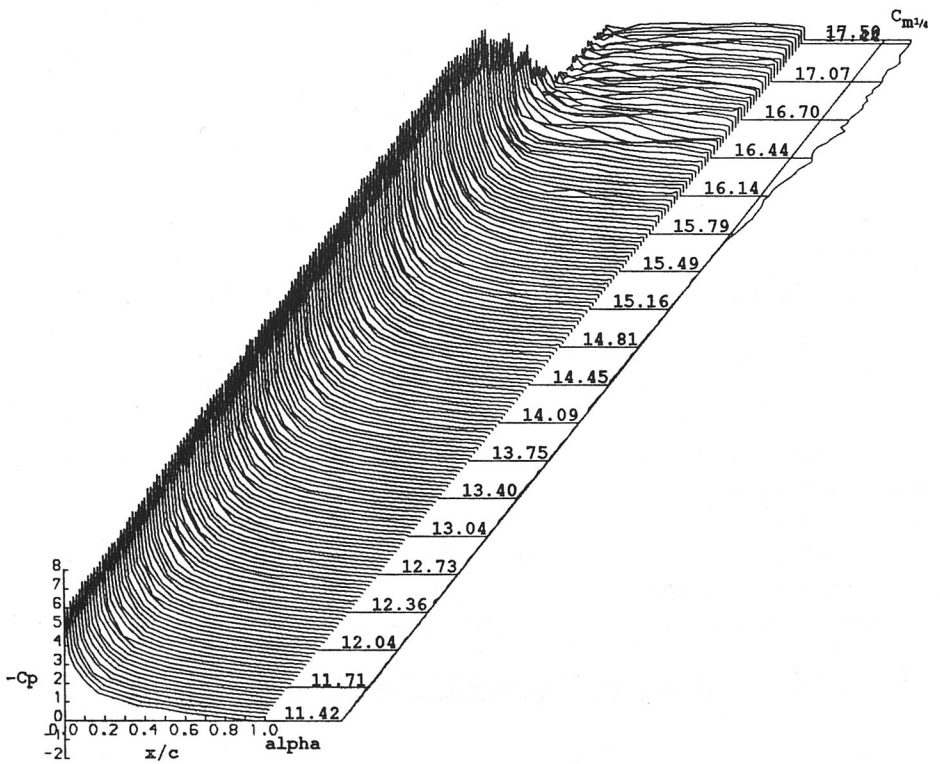


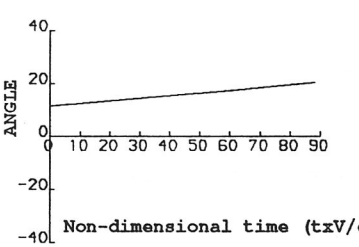


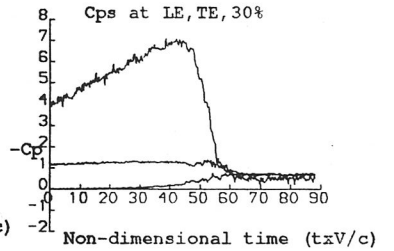


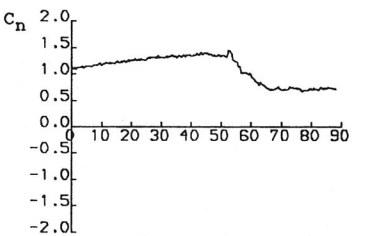
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

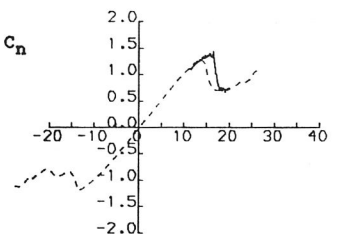
RUN REFERENCE NUMBER: 24481
DATE OF TEST: 7/3/91
REYNOLDS NUMBER = 1430339.
MACH NUMBER = 0.117
DYNAMIC PRESSURE = 951.20 Nm^{-2}
AIR TEMPERATURE = 24.3°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 212.99 Hz.
MOTION TYPE: RAMP UP
REDUCED PITCH RATE = 0.00083
START ANGLE = -1.00°
LINEAR PITCH RATE = 7.02°S^{-1}
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

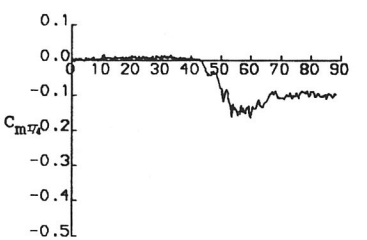


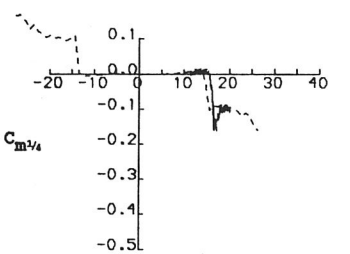


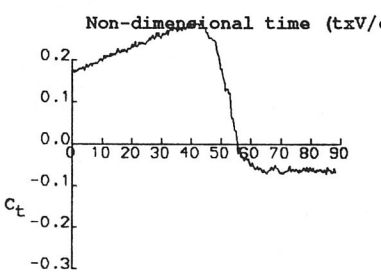


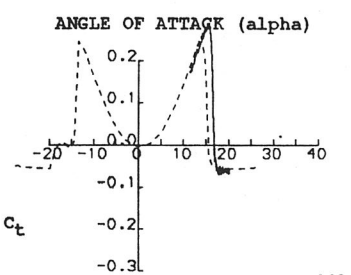








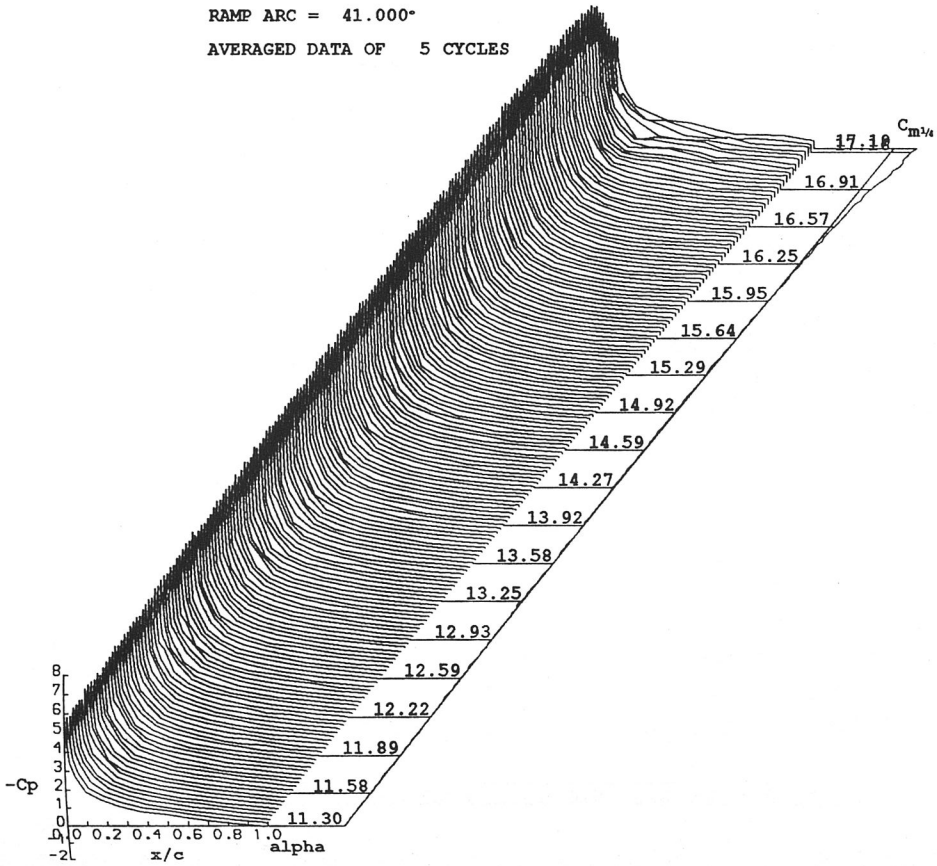


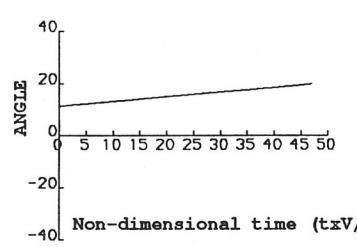


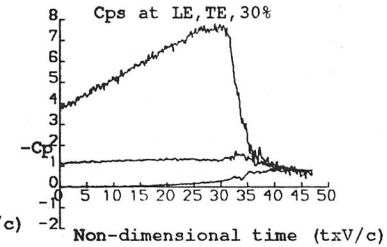
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

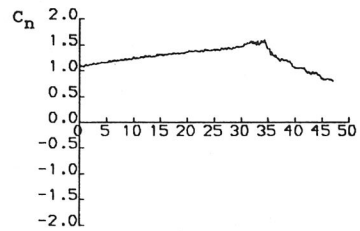
RUN REFERENCE NUMBER: 24491
REYNOLDS NUMBER = 1424198.
DYNAMIC PRESSURE = 951.20 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

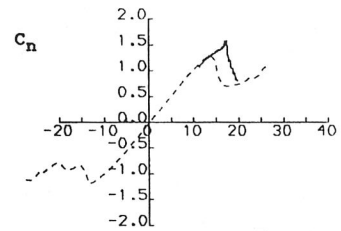
DATE OF TEST: 7/3/91
MACH NUMBER = 0.117
AIR TEMPERATURE = 25.3°C
SAMPLING FREQUENCY = 400.00 Hz.
REDUCED PITCH RATE = 0.00154
LINEAR PITCH RATE = 13.03°S^{-1}

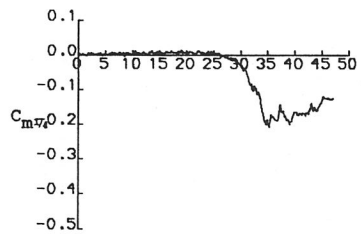


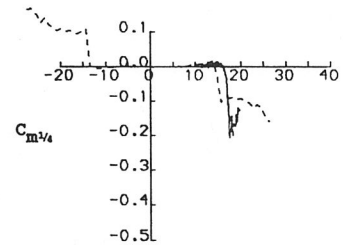


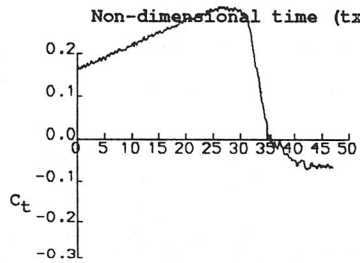


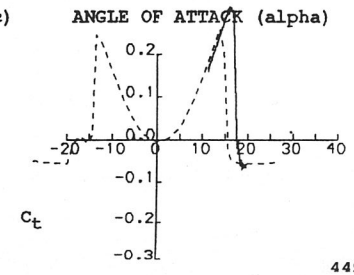






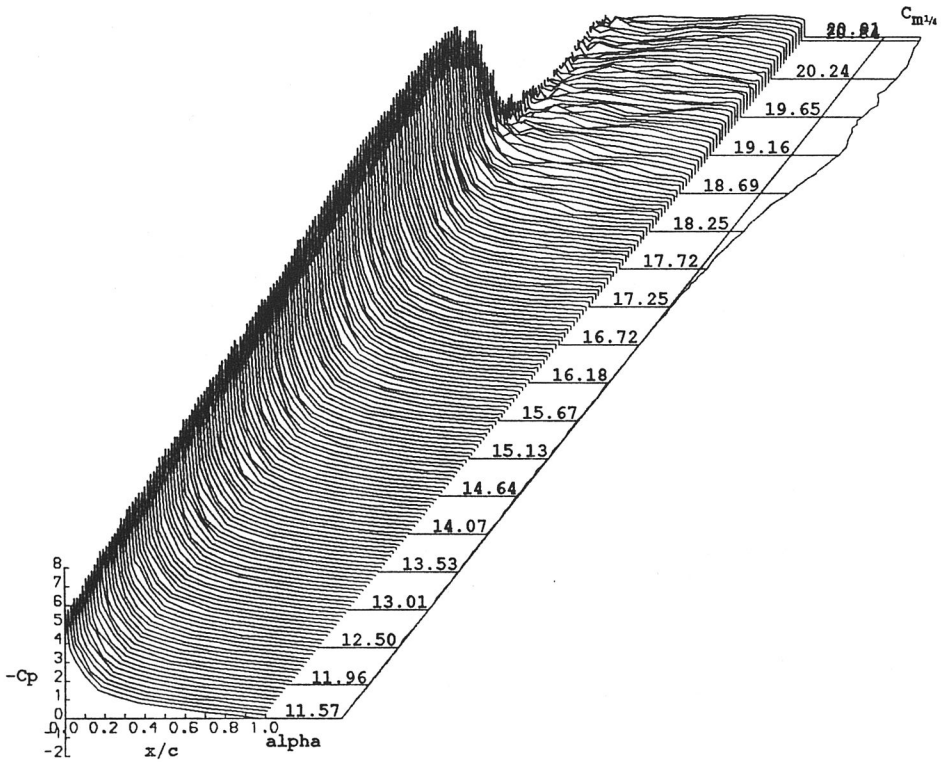


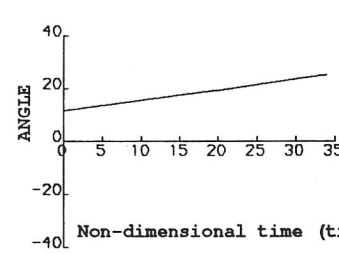


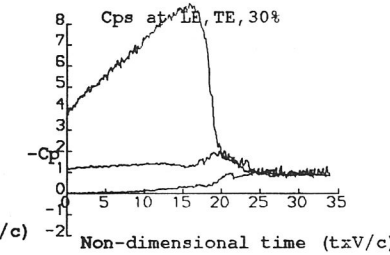


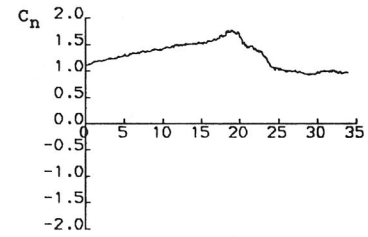
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

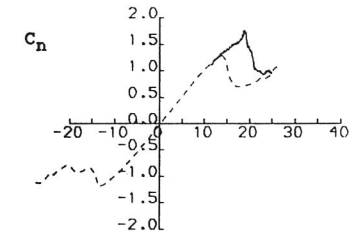
RUN REFERENCE NUMBER: 24501
DATE OF TEST: 7/3/91
REYNOLDS NUMBER = 1409933.
MACH NUMBER = 0.116
DYNAMIC PRESSURE = 934.64 Nm^{-2}
AIR TEMPERATURE = 25.6°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 550.05 Hz.
MOTION TYPE: RAMP UP
REDUCED PITCH RATE = 0.00336
START ANGLE = -1.00°
LINEAR PITCH RATE = 28.21°S^{-1}
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

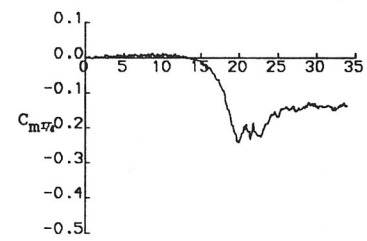


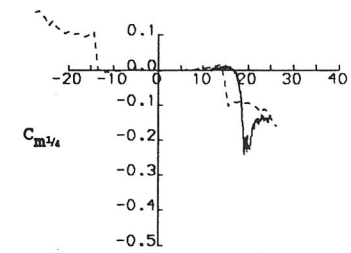


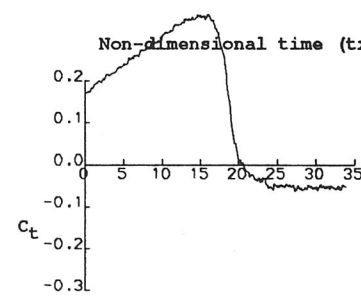


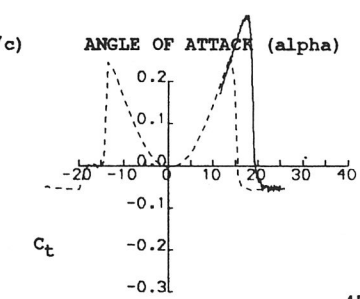








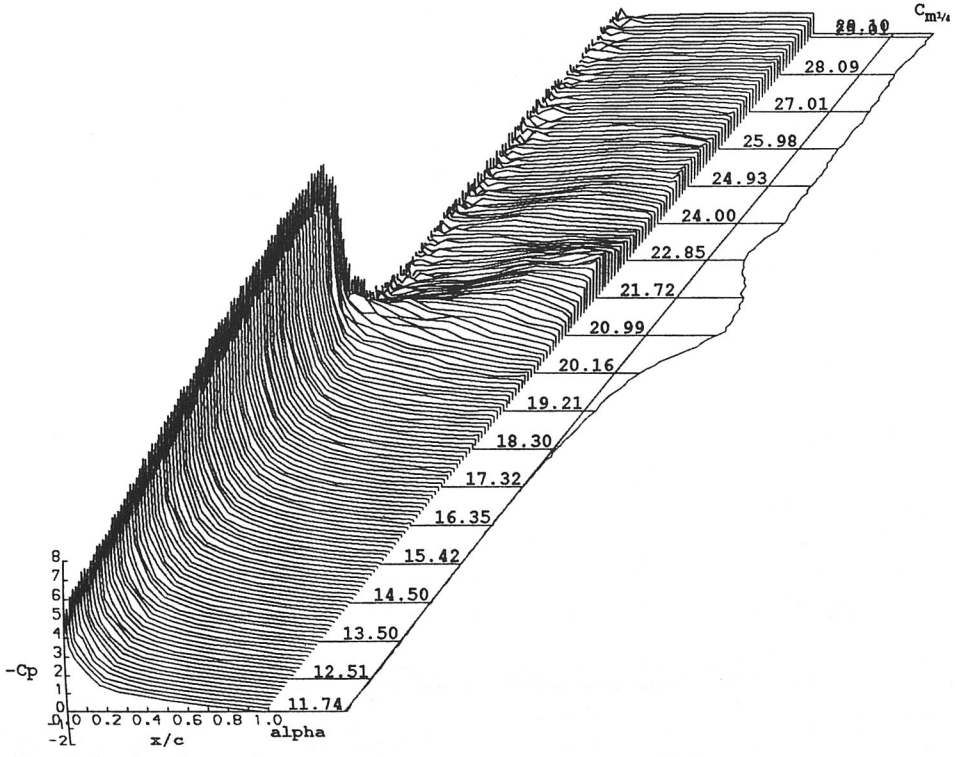


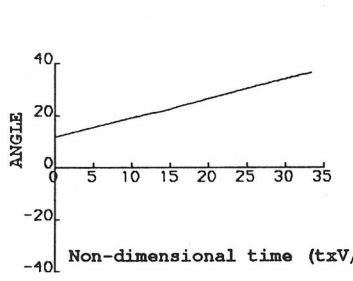


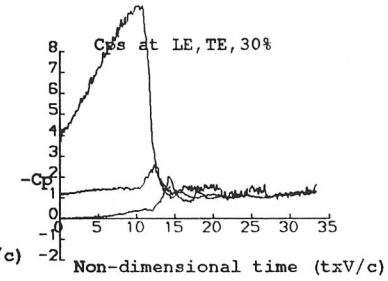
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

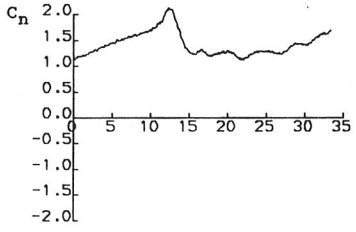
RUN REFERENCE NUMBER: 24511
REYNOLDS NUMBER = 1389918.
DYNAMIC PRESSURE = 907.51 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

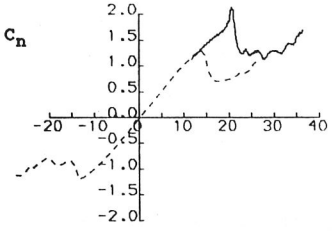
DATE OF TEST: 7/3/91
MACH NUMBER = 0.115
AIR TEMPERATURE = 25.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.00623
LINEAR PITCH RATE = 51.54°S^{-1}

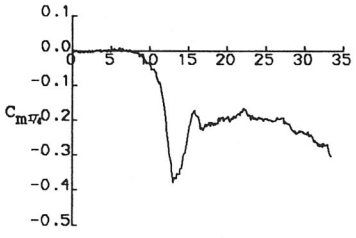


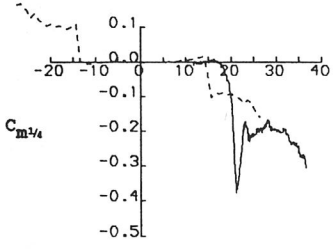


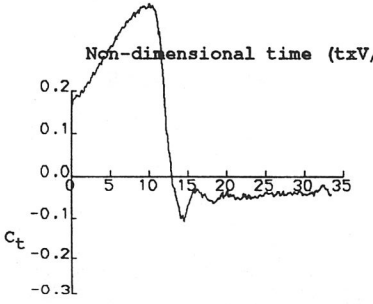


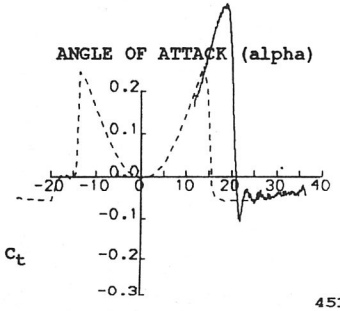








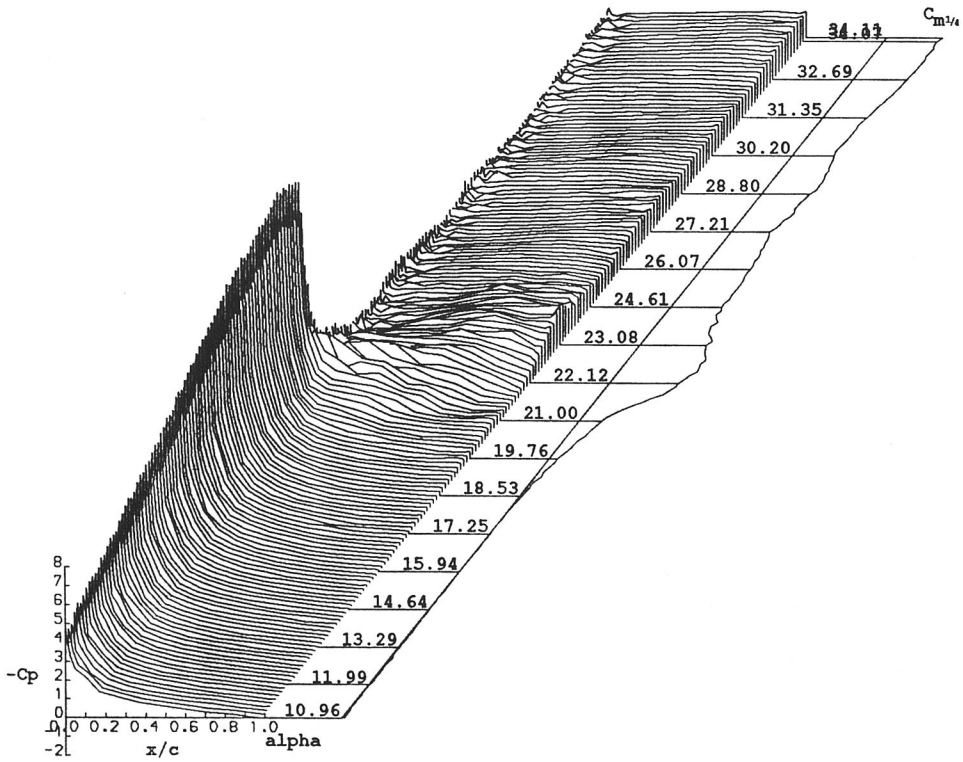


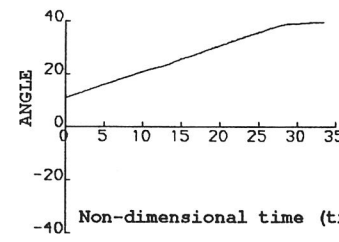


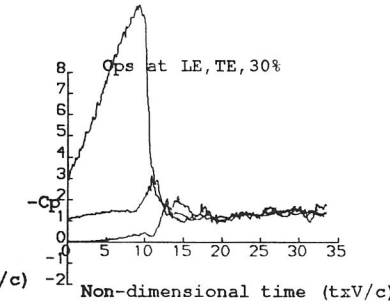
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

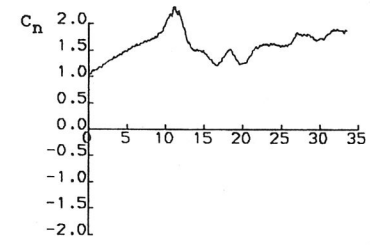
RUN REFERENCE NUMBER: 24521
REYNOLDS NUMBER = 1384570.
DYNAMIC PRESSURE = 907.51 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

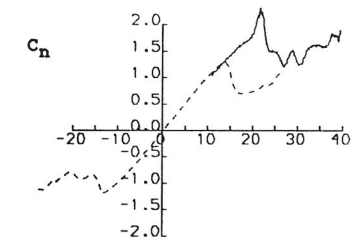
DATE OF TEST: 7/3/91
MACH NUMBER = 0.115
AIR TEMPERATURE = 26.4°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.00837
LINEAR PITCH RATE = 69.36°S^{-1}

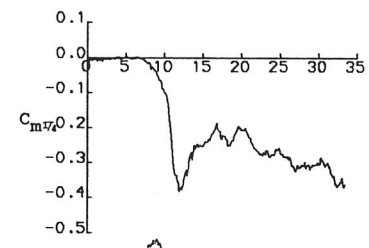


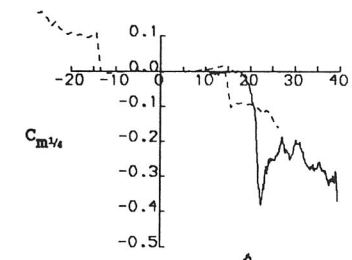


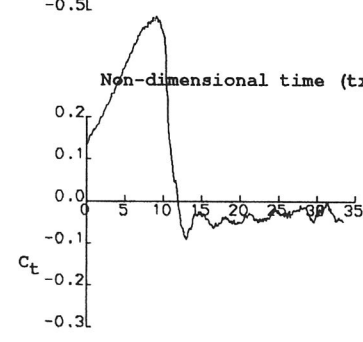


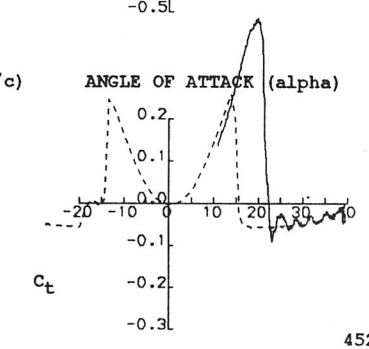








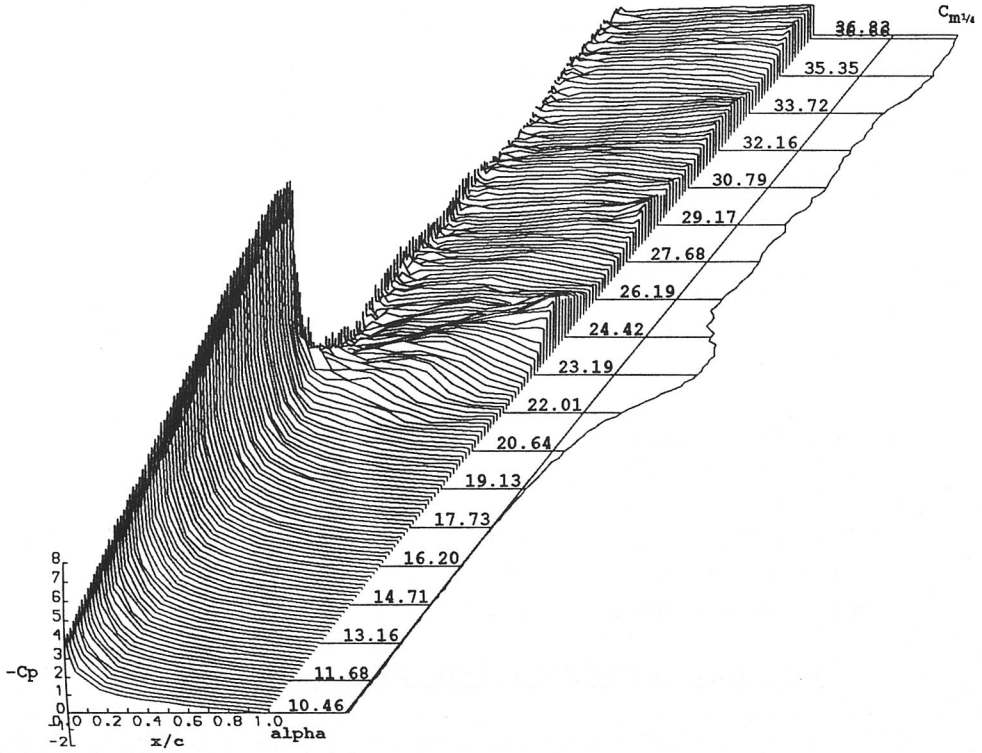


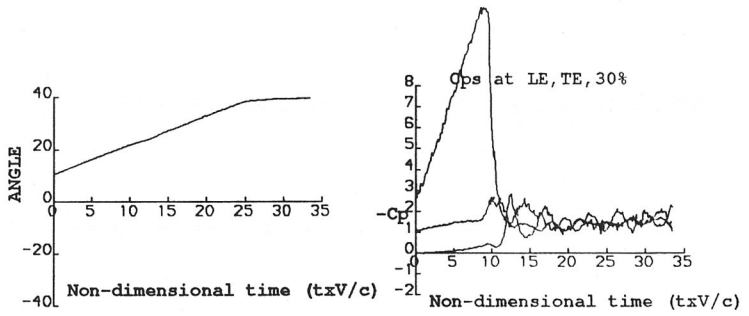


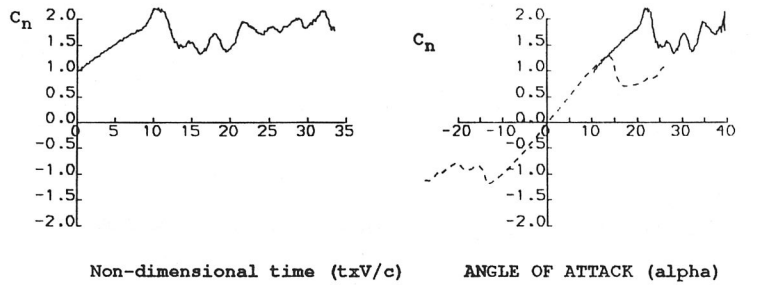
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

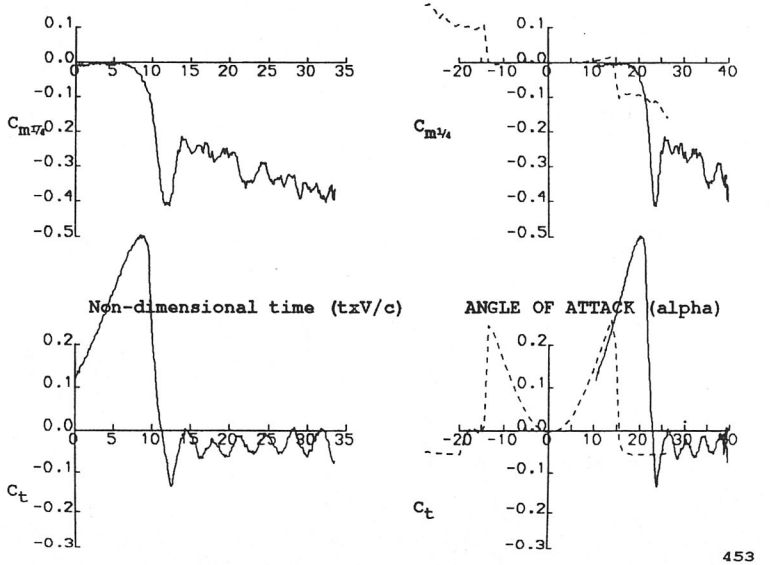
RUN REFERENCE NUMBER: 24531
REYNOLDS NUMBER = 1381026.
DYNAMIC PRESSURE = 907.51 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = -1.00°
RAMP ARC = 41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 7/3/91
MACH NUMBER = 0.115
AIR TEMPERATURE = 27.0°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.00893
LINEAR PITCH RATE = 74.08°S^{-1}





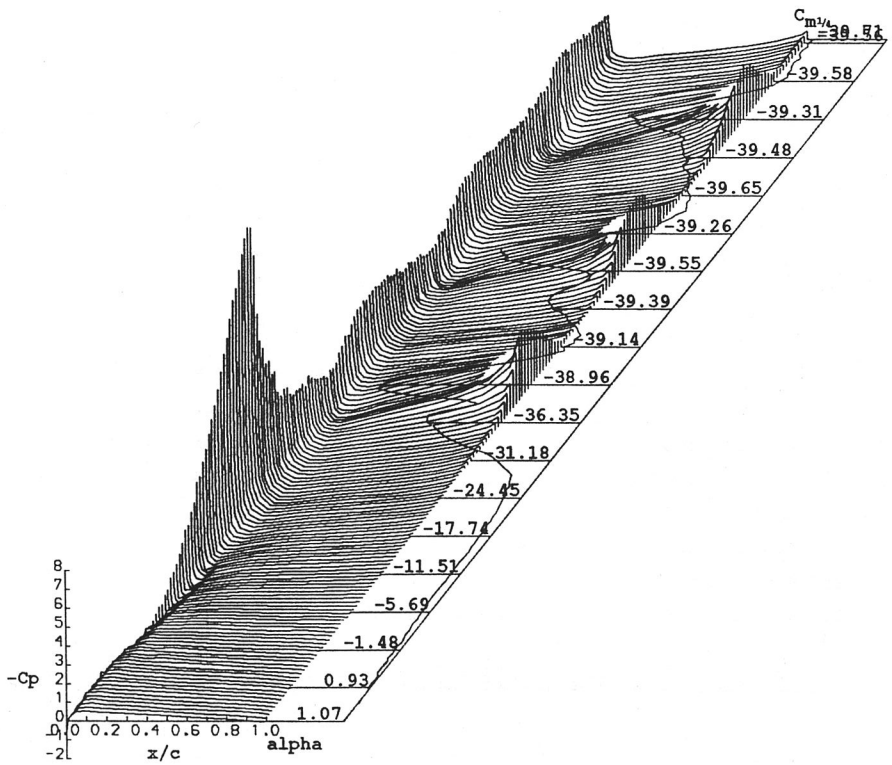


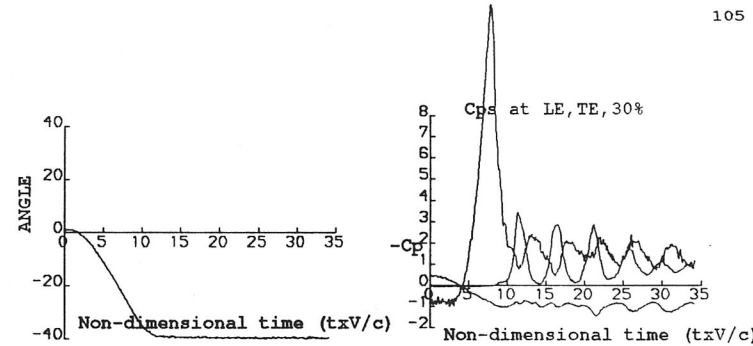


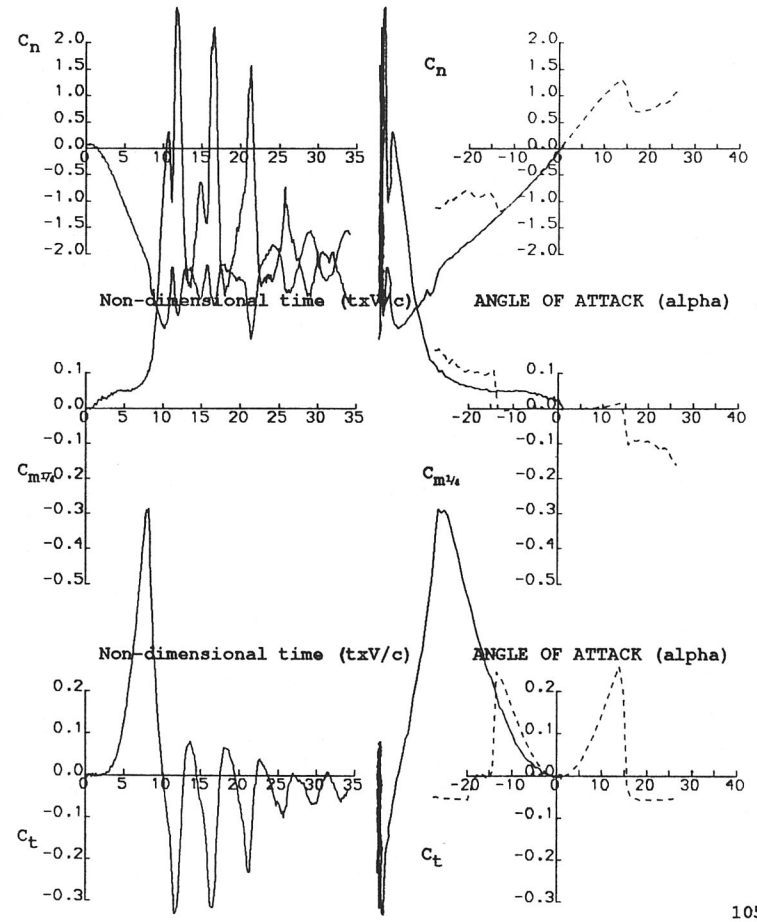
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621051
REYNOLDS NUMBER = 1470622.
DYNAMIC PRESSURE = 981.54 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 25.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03995
LINEAR PITCH RATE = -337.80°S^{-1}



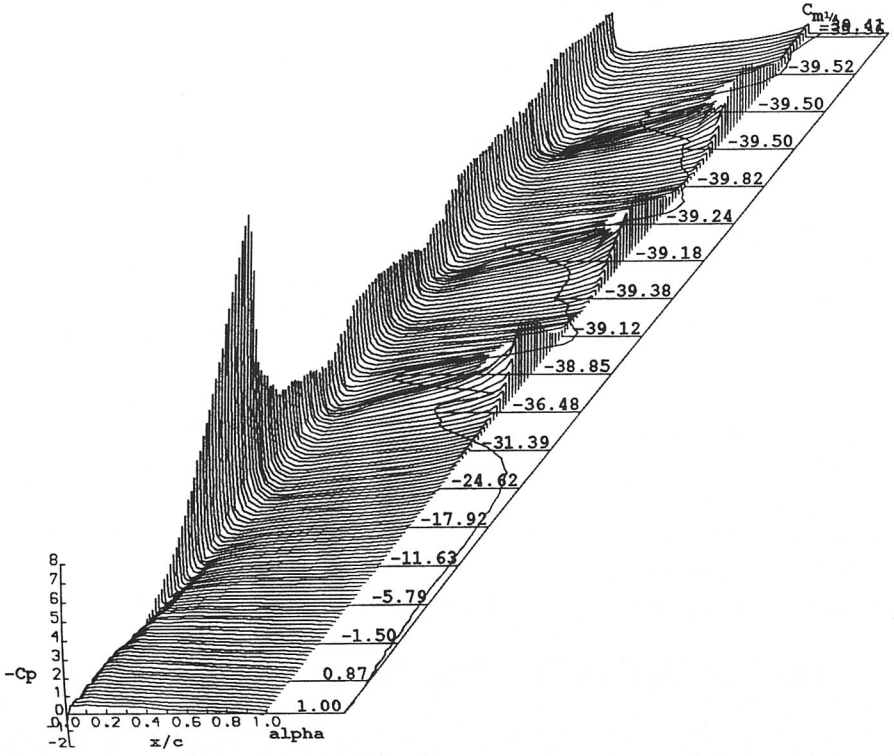


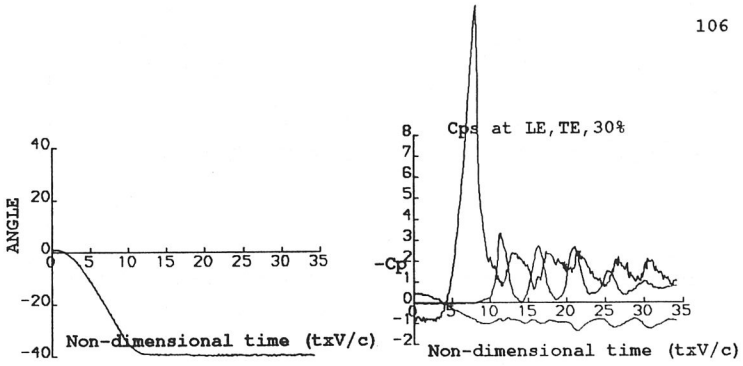


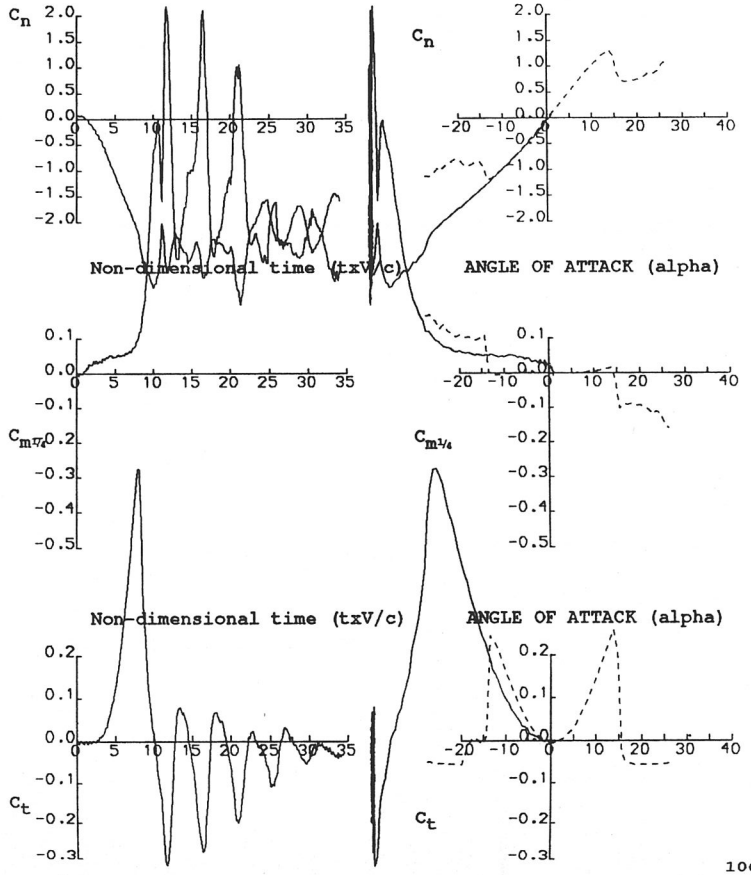
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621061
REYNOLDS NUMBER = 1466848.
DYNAMIC PRESSURE = 981.54 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.04073
LINEAR PITCH RATE = $-344.81°S^{-1}$



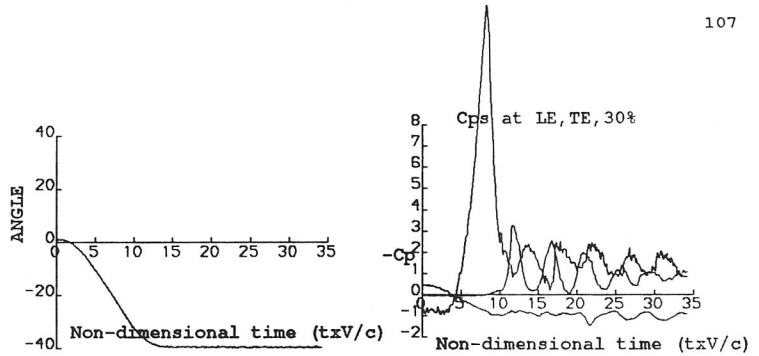


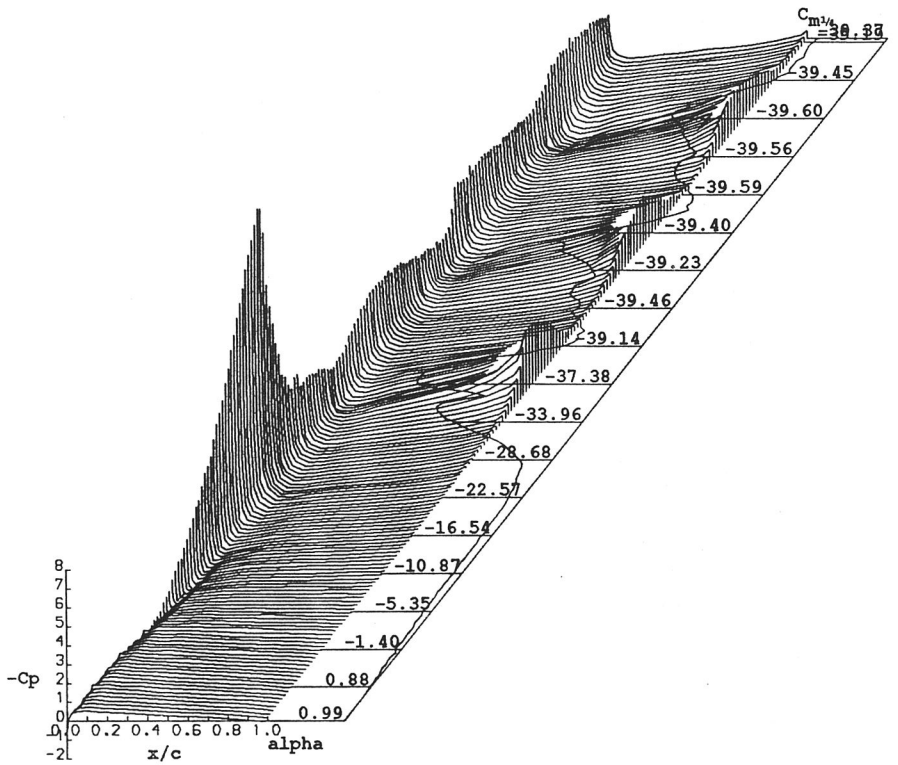


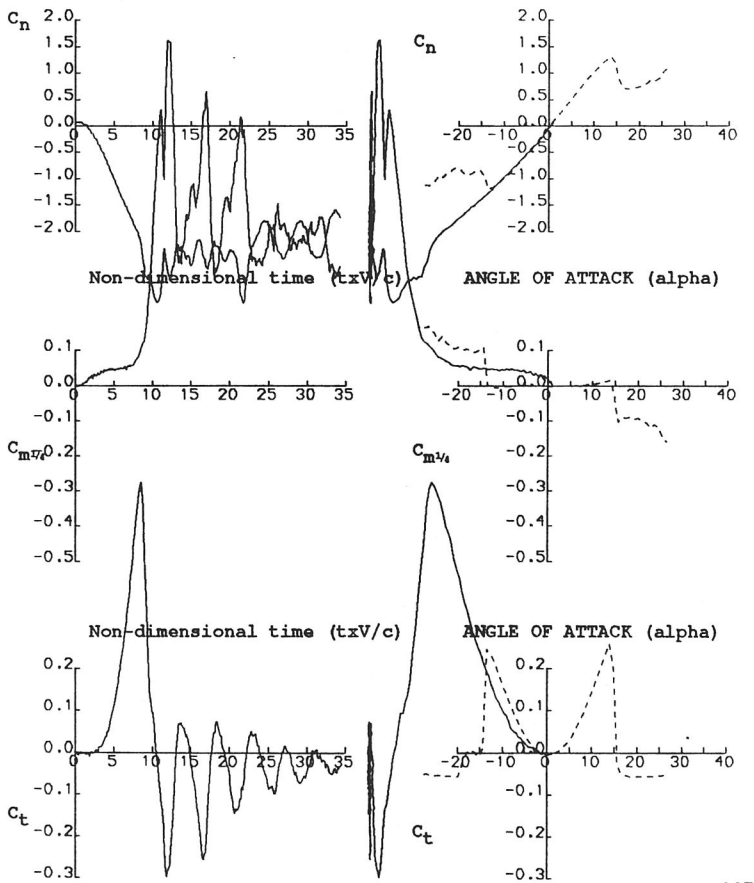
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621071
REYNOLDS NUMBER = 1464342.
DYNAMIC PRESSURE = 981.54 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03761
LINEAR PITCH RATE = -318.56°S^{-1}



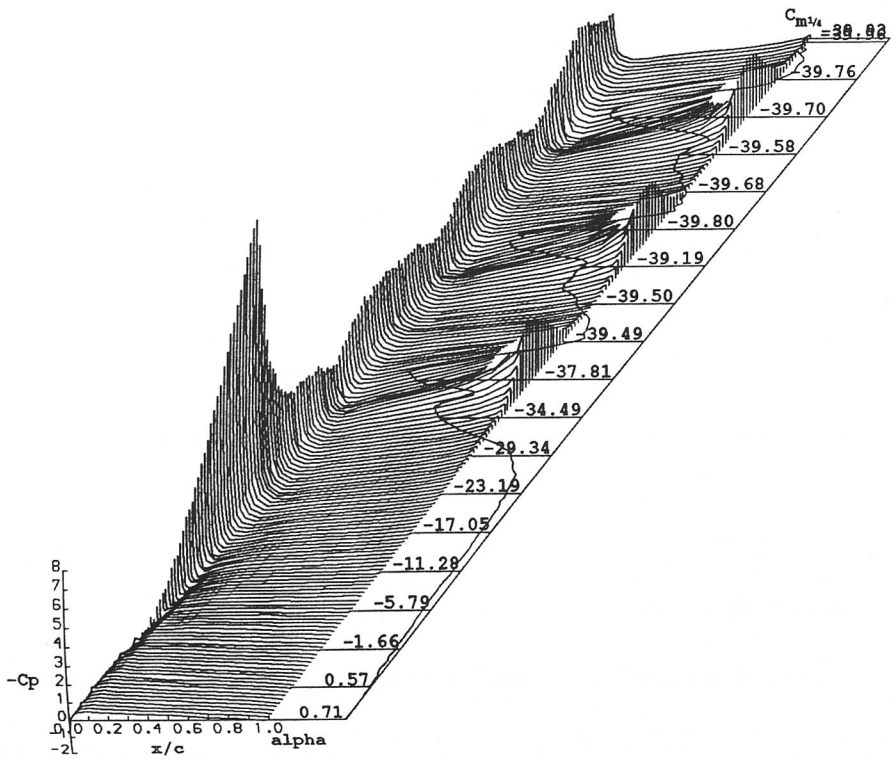


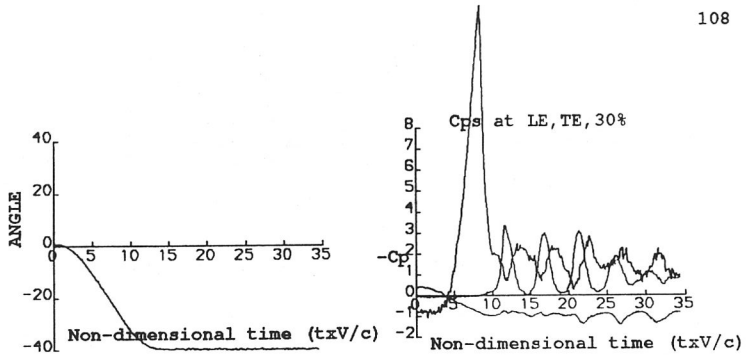


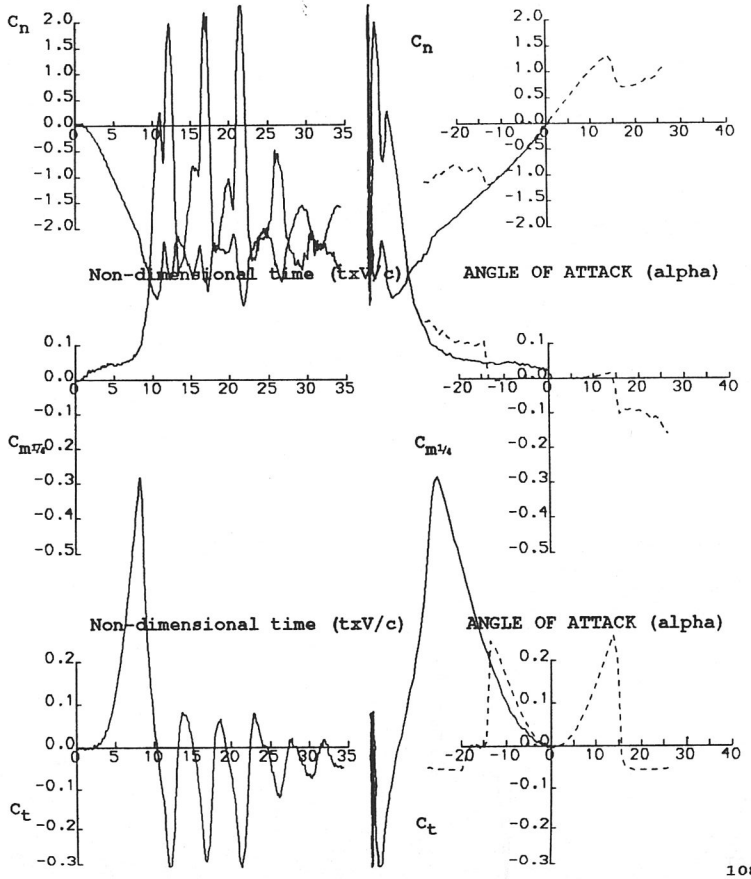
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621081
REYNOLDS NUMBER = 1471657.
DYNAMIC PRESSURE = 990.52 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 26.6°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03745
LINEAR PITCH RATE = $-318.63°S^{-1}$



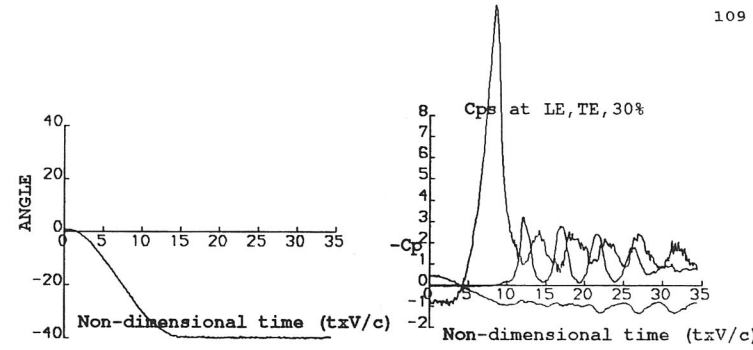


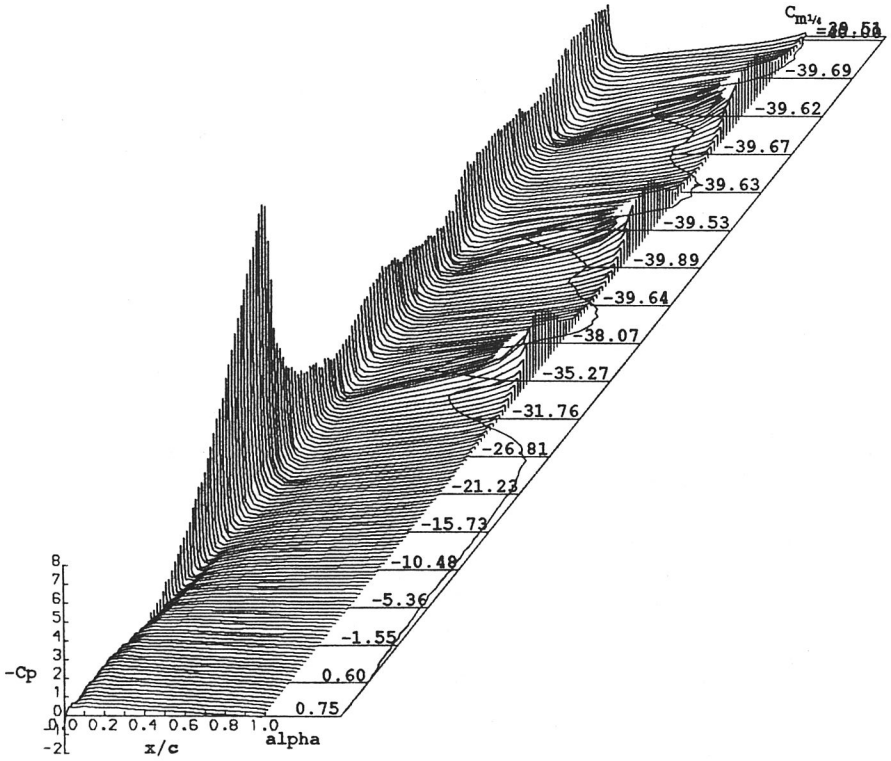


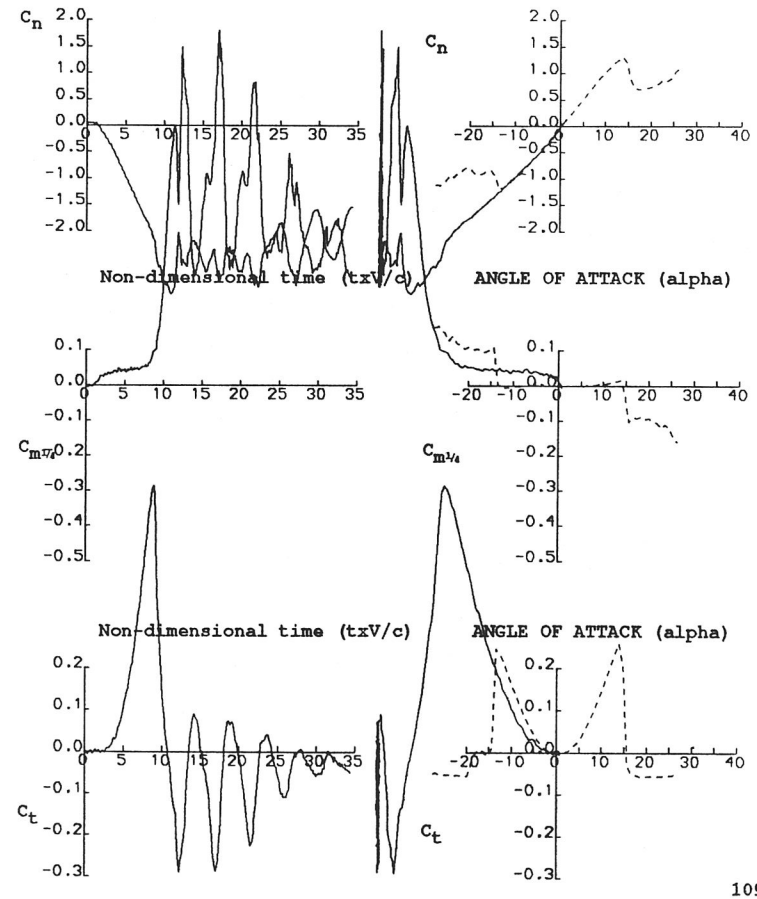
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621091
REYNOLDS NUMBER = 1467893.
DYNAMIC PRESSURE = 990.52 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 27.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03461
LINEAR PITCH RATE = -294.76°S^{-1}



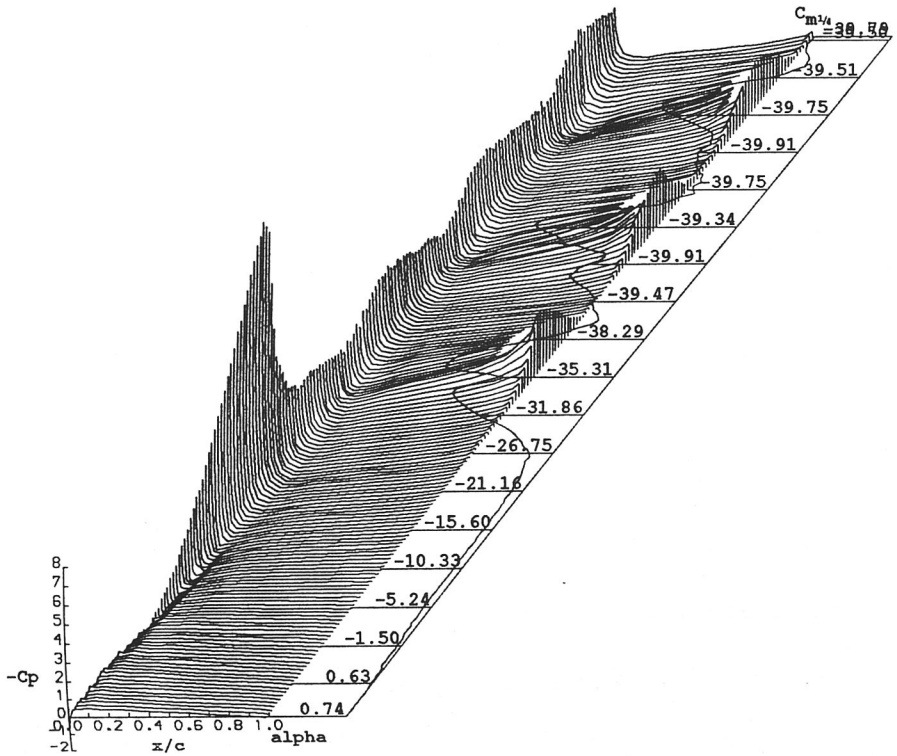


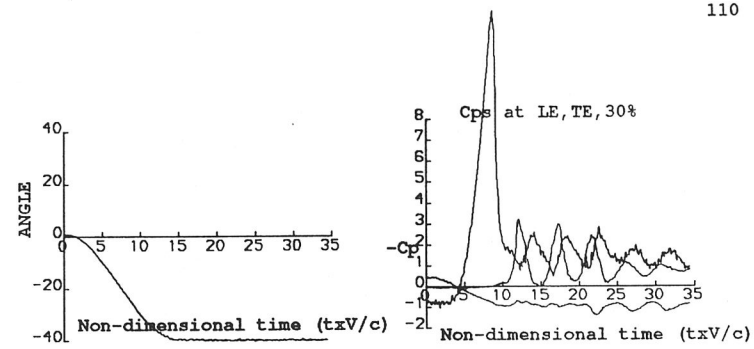


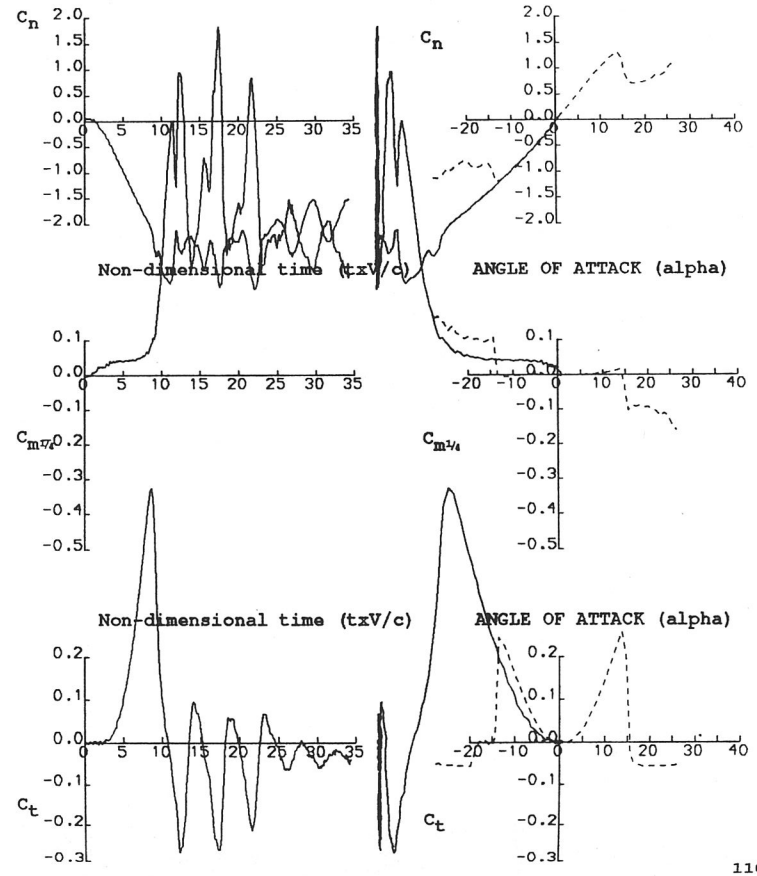
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621101
REYNOLDS NUMBER = 1466643.
DYNAMIC PRESSURE = 990.52 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 27.4°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03491
LINEAR PITCH RATE = -297.40°S^{-1}



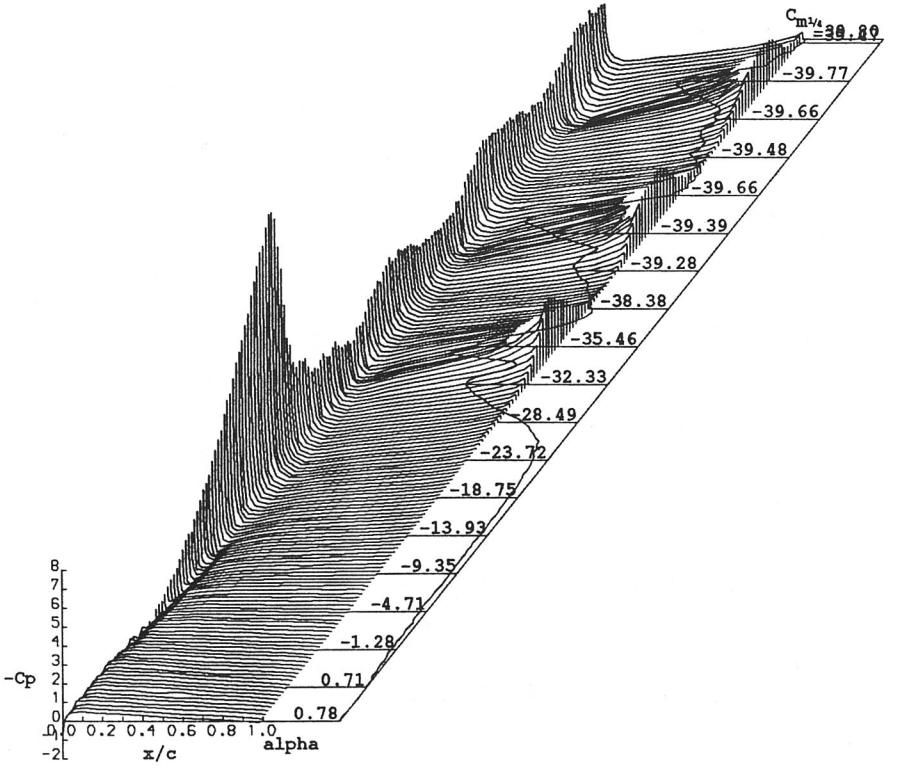


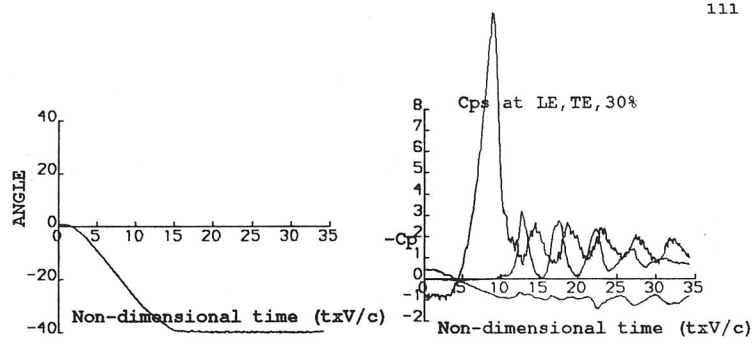


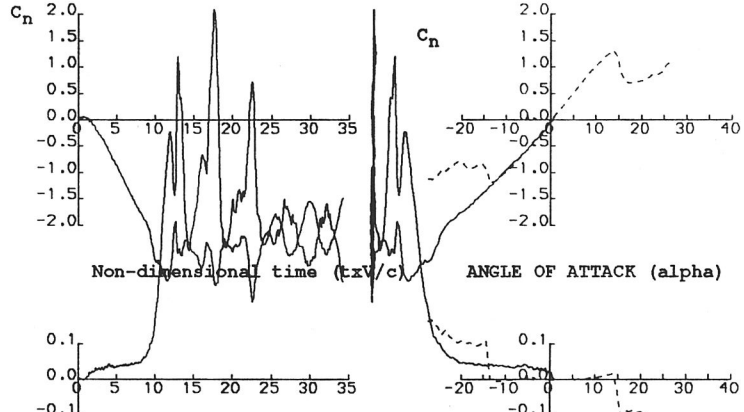
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

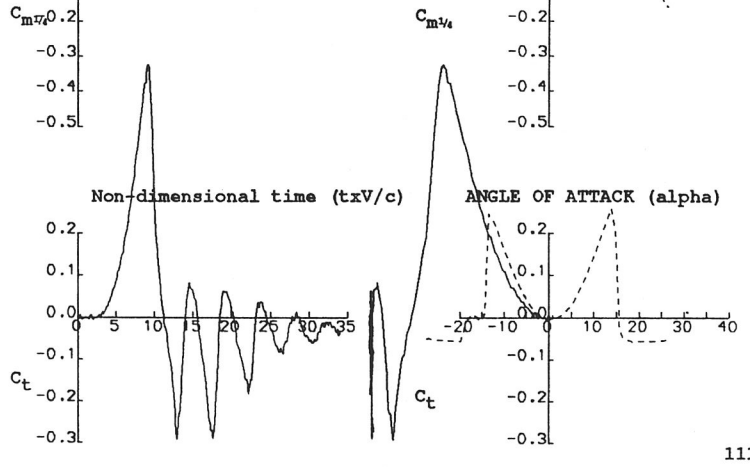
RUN REFERENCE NUMBER: 621111
REYNOLDS NUMBER = 1460731.
DYNAMIC PRESSURE = 981.71 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 27.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03078
LINEAR PITCH RATE = -261.02°S^{-1}





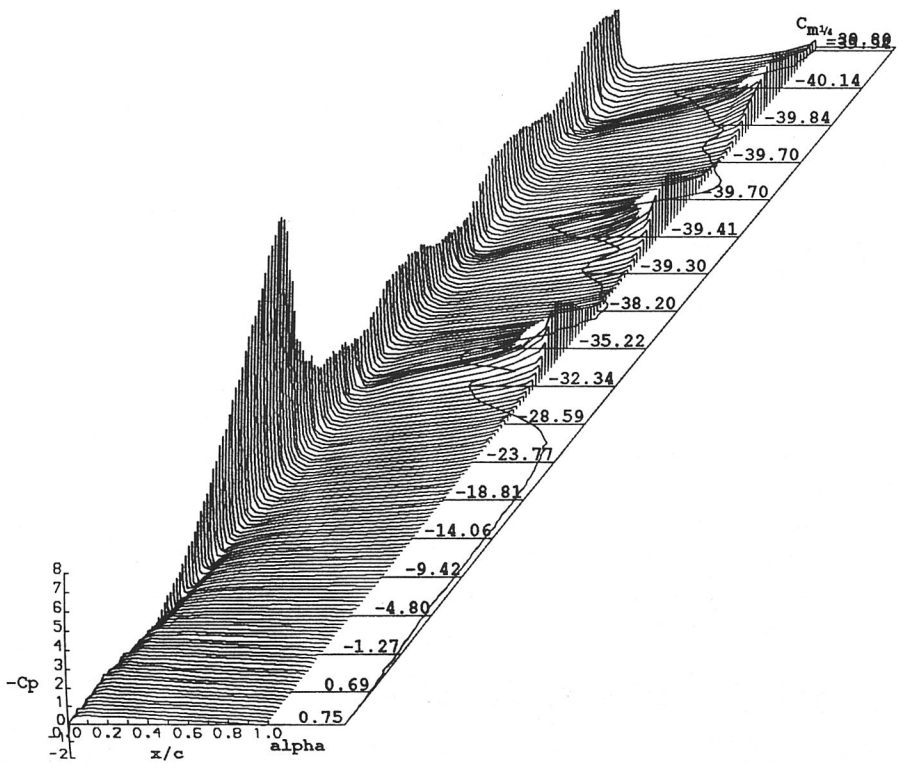


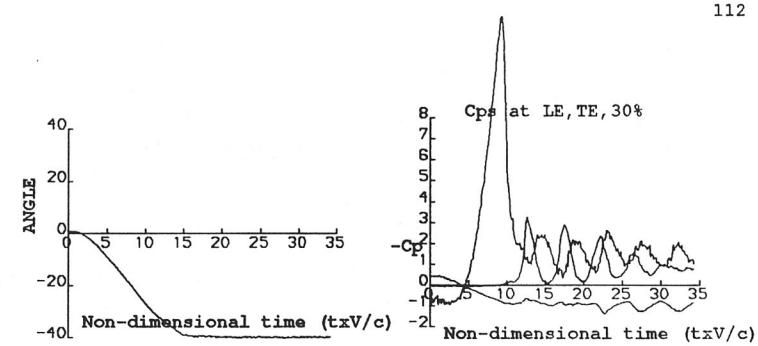


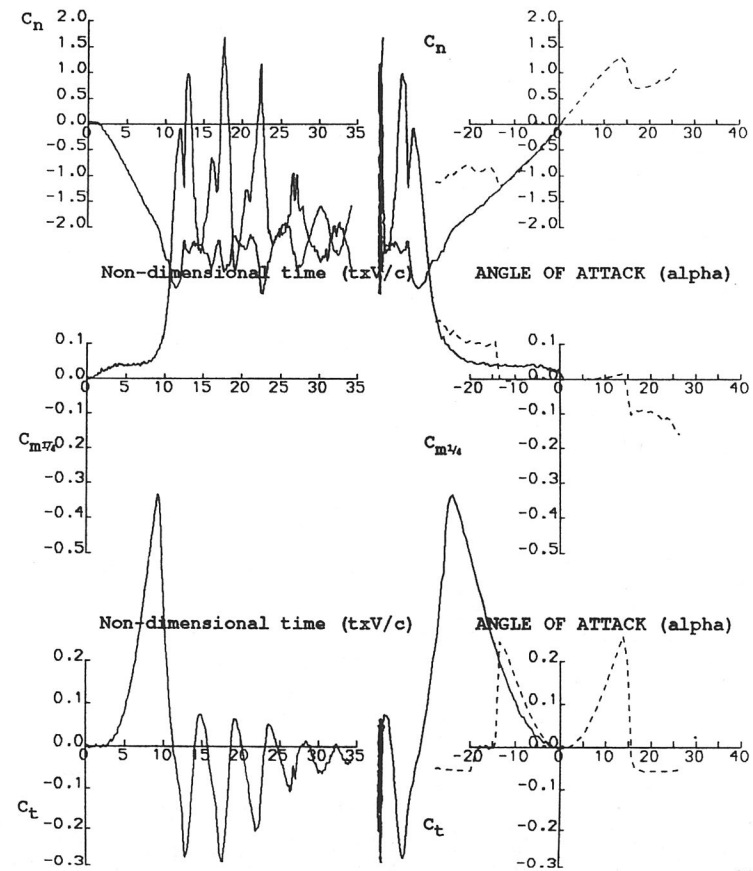
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621121
REYNOLDS NUMBER = 1457625.
DYNAMIC PRESSURE = 981.71 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 27.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03084
LINEAR PITCH RATE = $-261.77°S^{-1}$



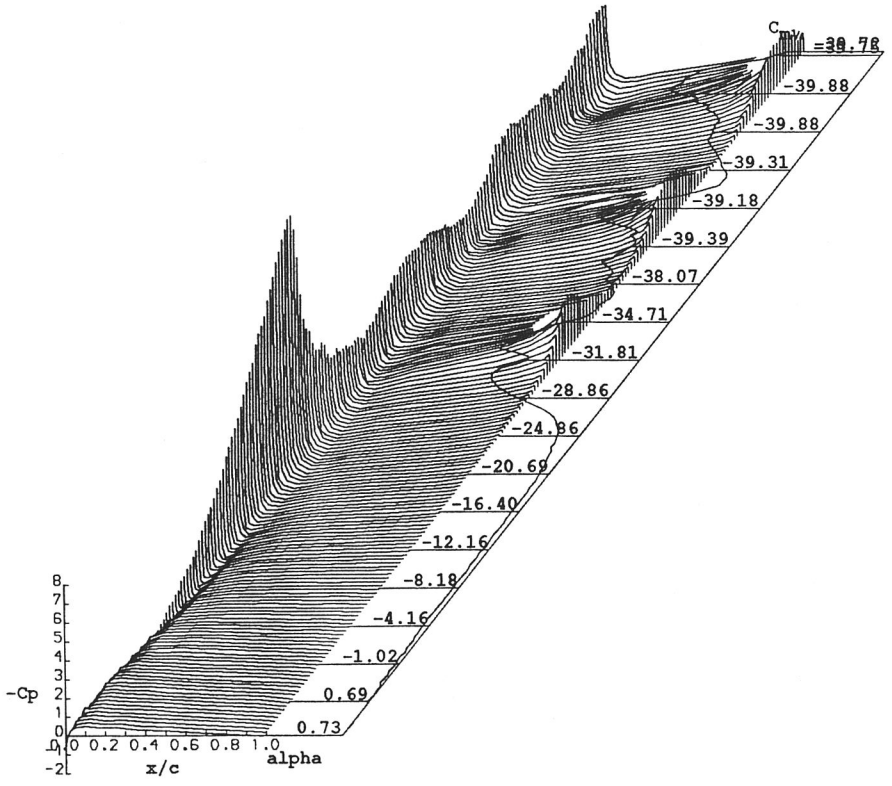


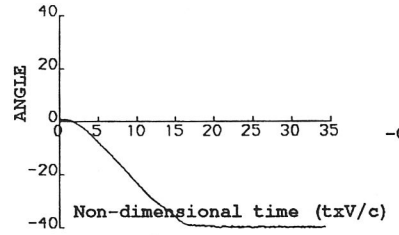


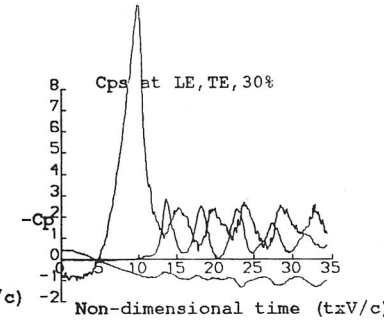
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

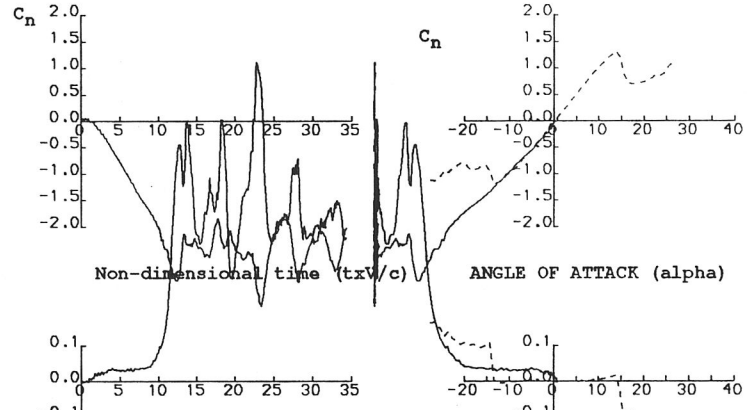
RUN REFERENCE NUMBER: 621131
REYNOLDS NUMBER = 1455767.
DYNAMIC PRESSURE = 981.71 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

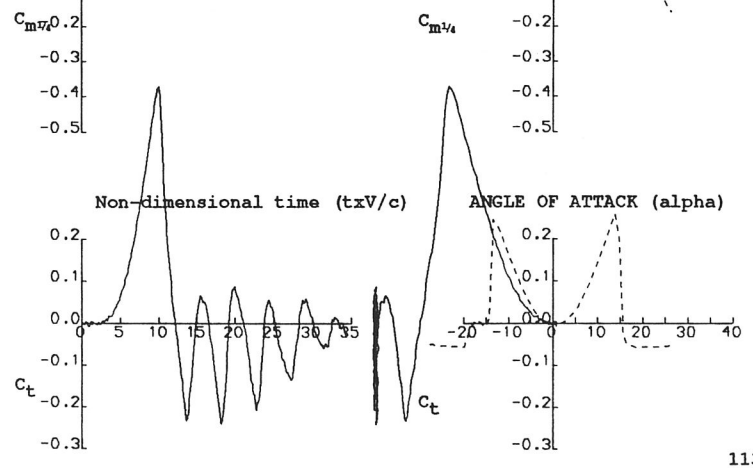
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 28.1°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02733
LINEAR PITCH RATE = $-232.03°S^{-1}$







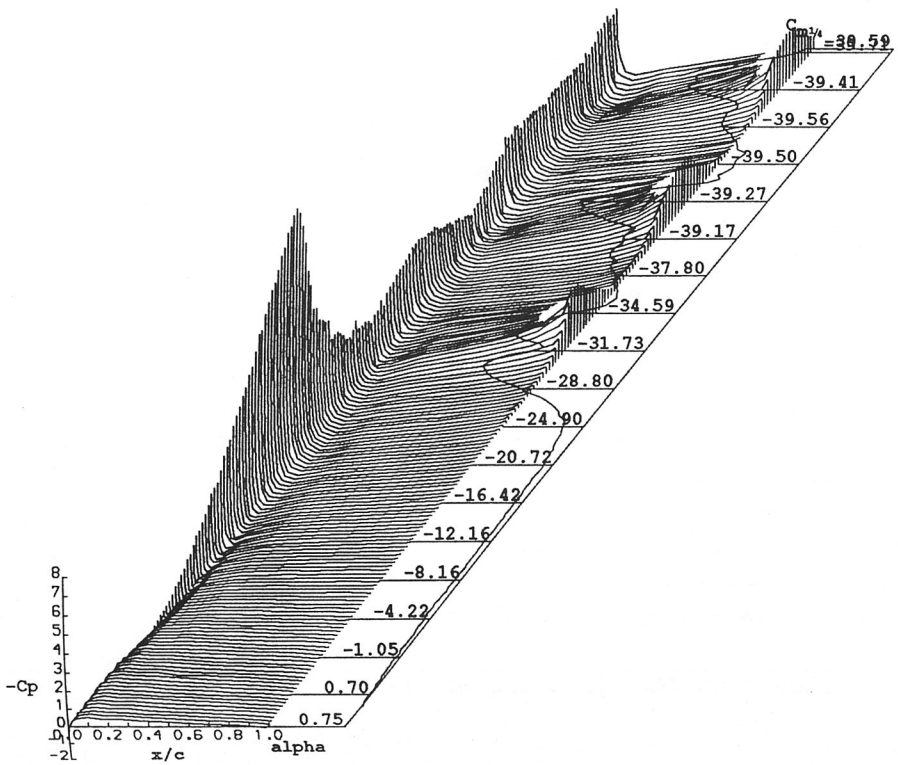


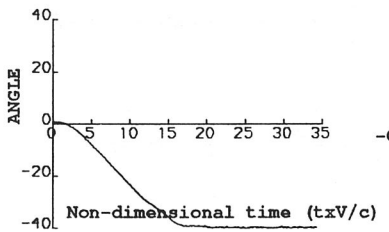


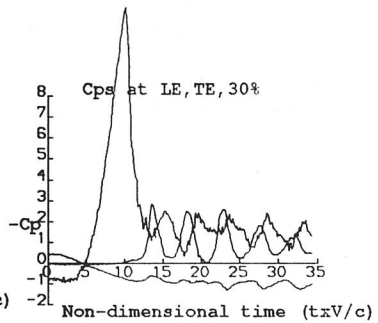
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

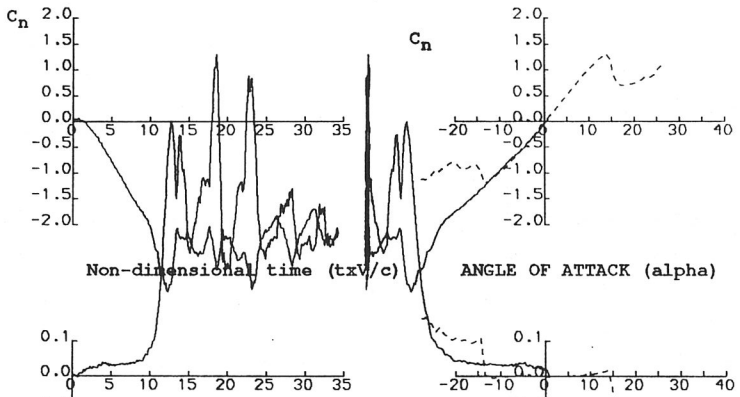
RUN REFERENCE NUMBER: 621141
REYNOLDS NUMBER = 1454531.
DYNAMIC PRESSURE = 981.71 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

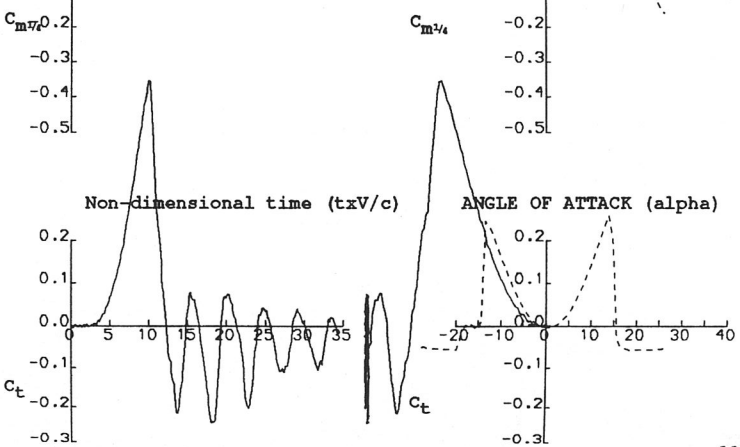
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 28.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02732
LINEAR PITCH RATE = $-232.03°S^{-1}$







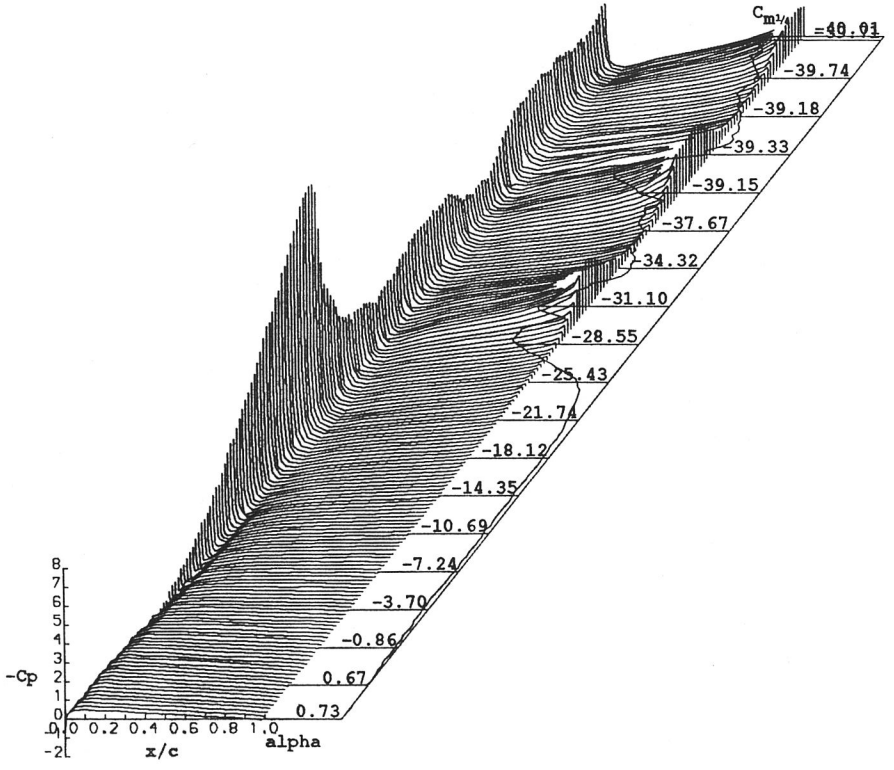


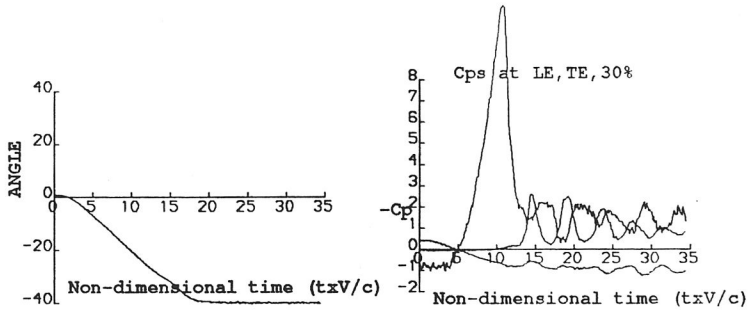


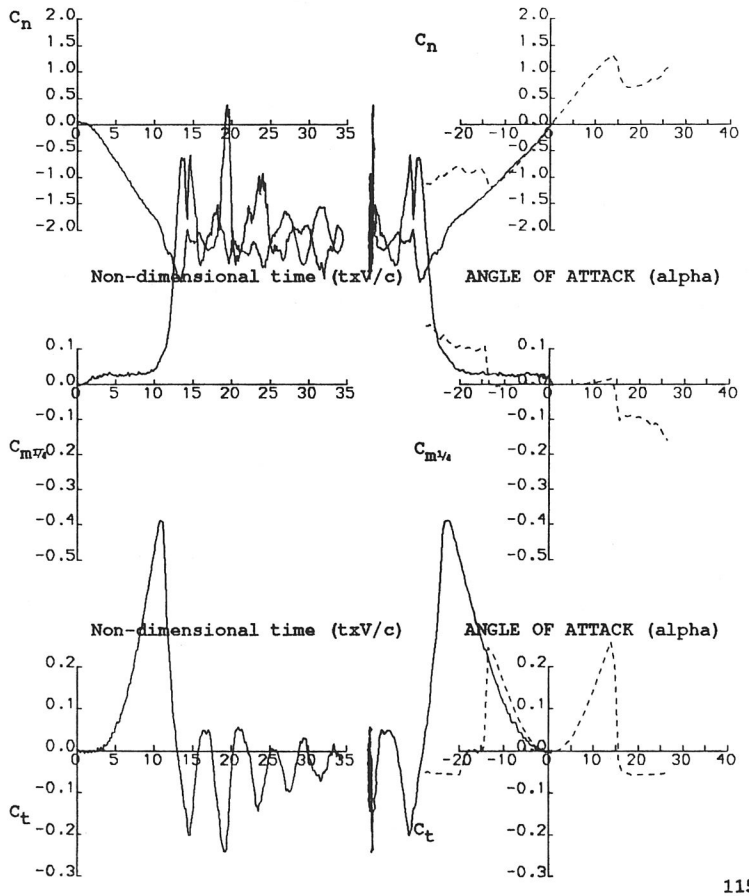
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621151
REYNOLDS NUMBER = 1459694.
DYNAMIC PRESSURE = 989.54 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 28.4°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02393
LINEAR PITCH RATE = -204.06°S^{-1}



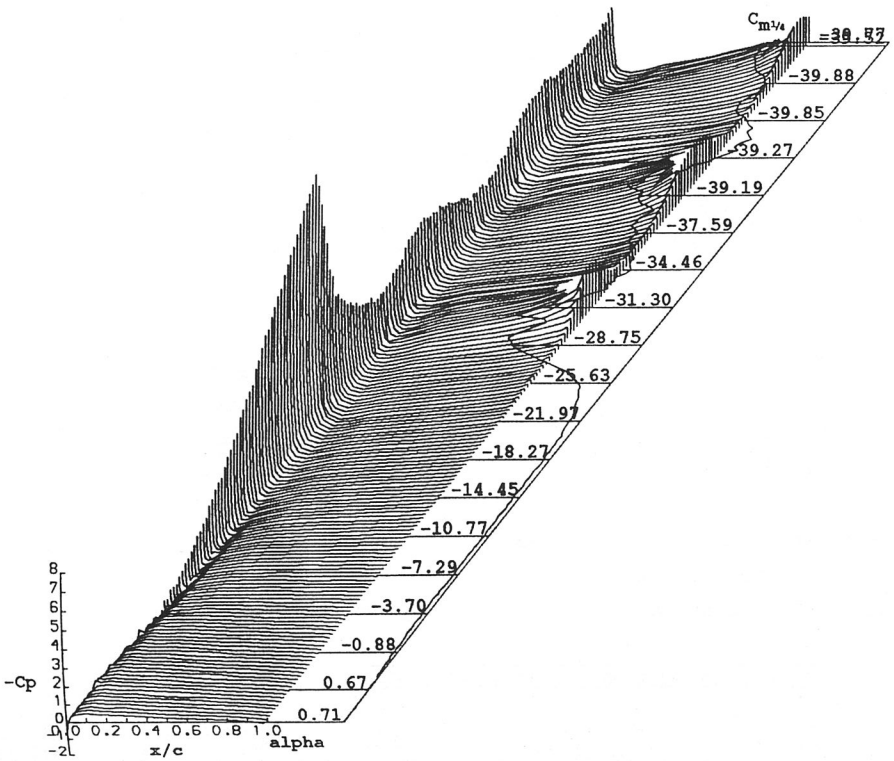


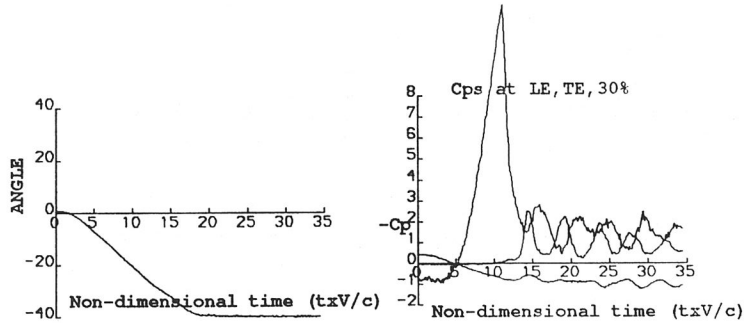


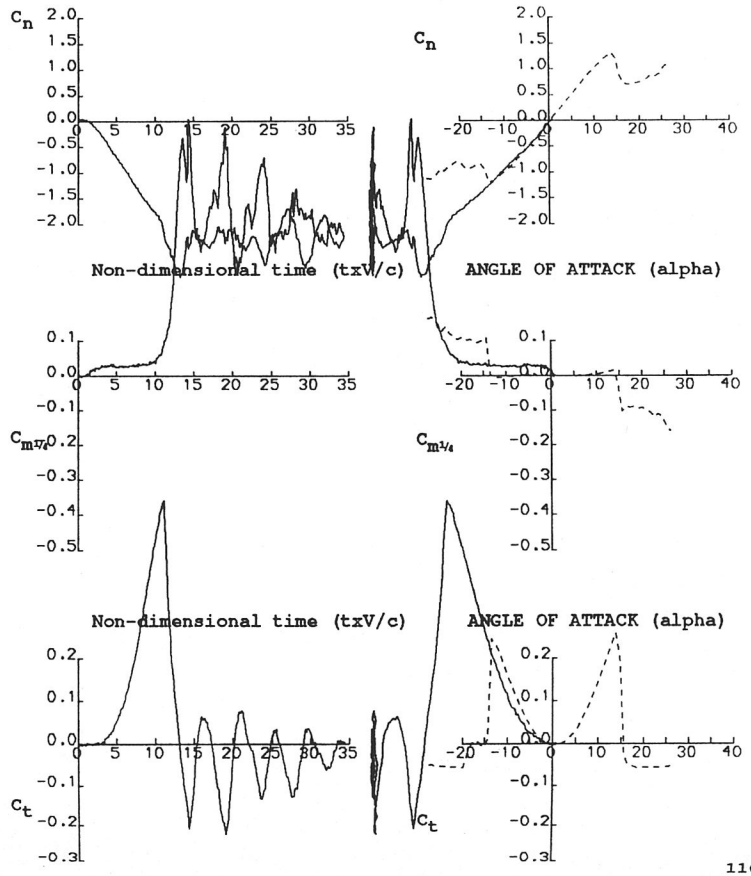
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621161
REYNOLDS NUMBER = 1457838.
DYNAMIC PRESSURE = 989.54 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 28.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02389
LINEAR PITCH RATE = -203.90°S^{-1}



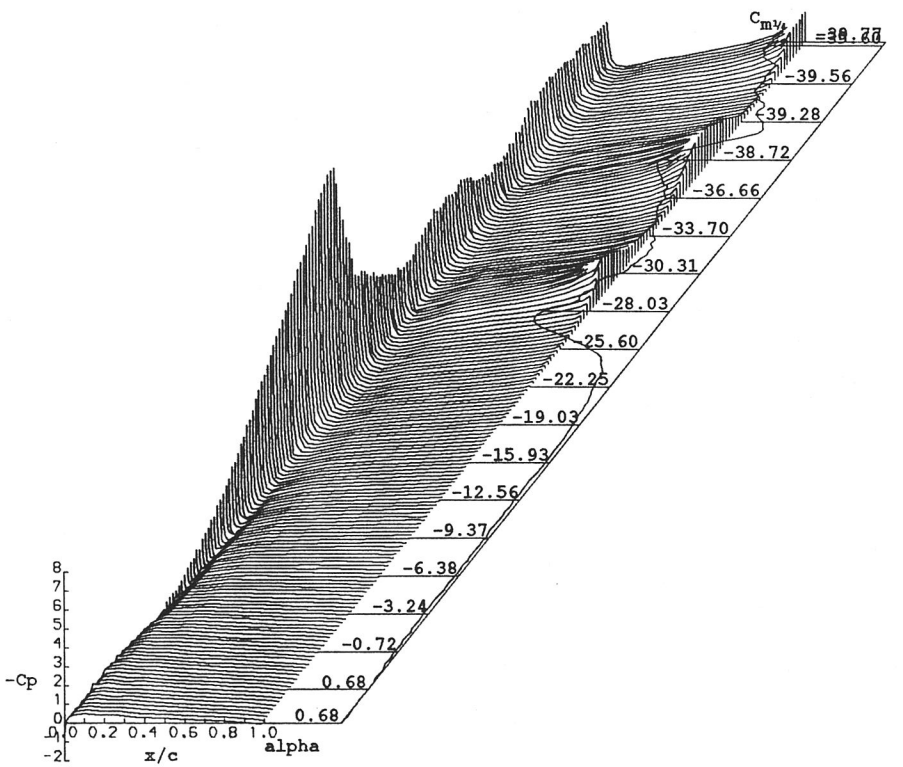


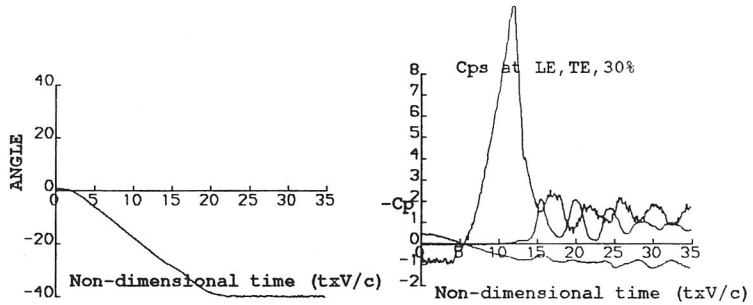


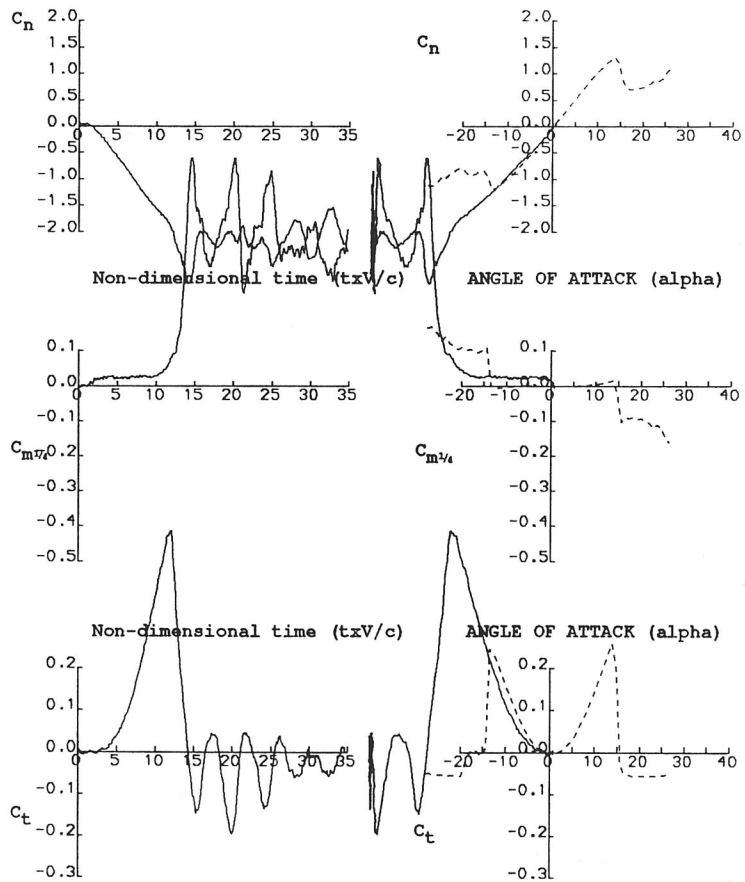
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621171
REYNOLDS NUMBER = 1456604.
DYNAMIC PRESSURE = 989.54 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 28.9°C
SAMPLING FREQUENCY = 544.96 Hz.
REDUCED PITCH RATE = -0.02052
LINEAR PITCH RATE = $-175.16°S^{-1}$



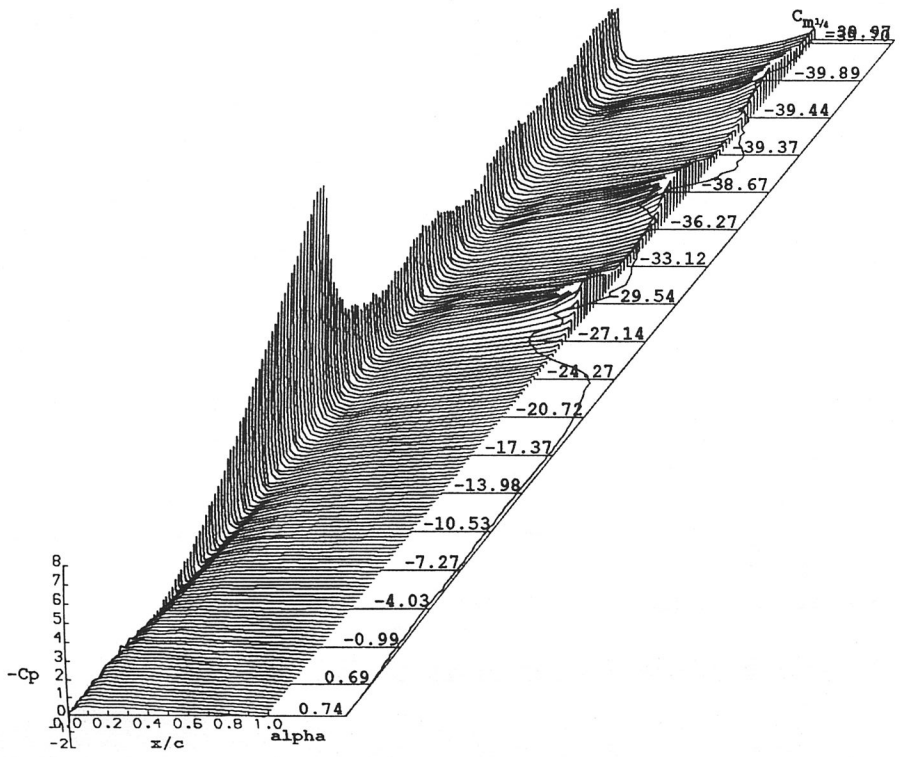


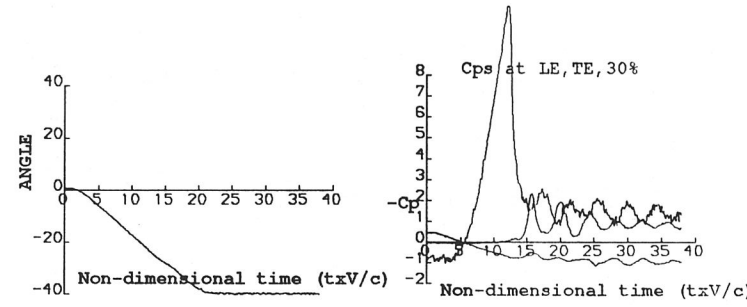


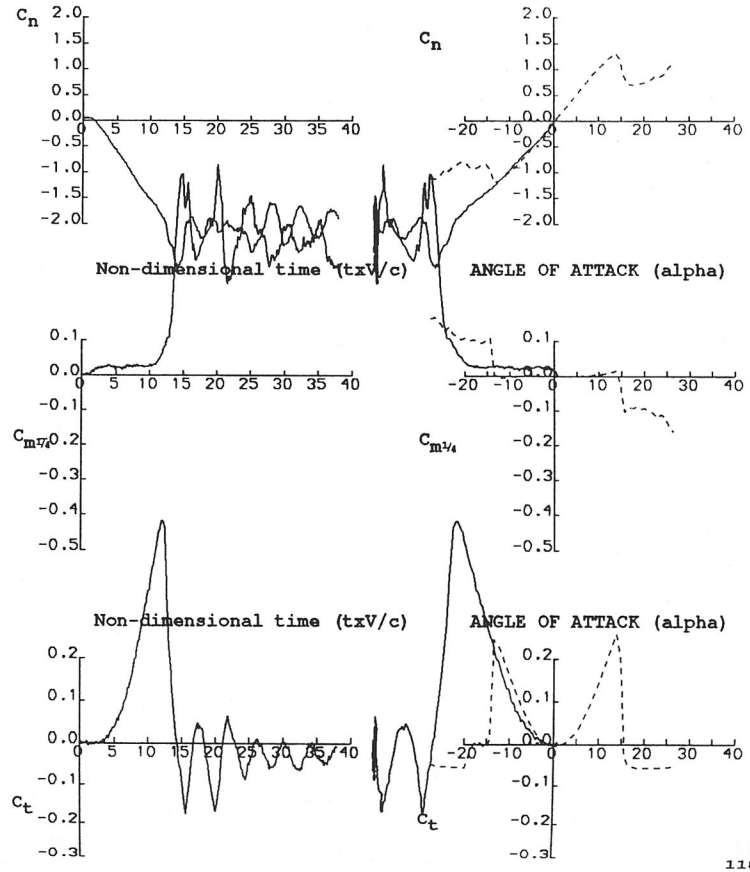
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621181
REYNOLDS NUMBER = 1453525.
DYNAMIC PRESSURE = 989.54 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 29.4°C
SAMPLING FREQUENCY = 500.00 Hz.
REDUCED PITCH RATE = -0.01985
LINEAR PITCH RATE = -169.61°S^{-1}



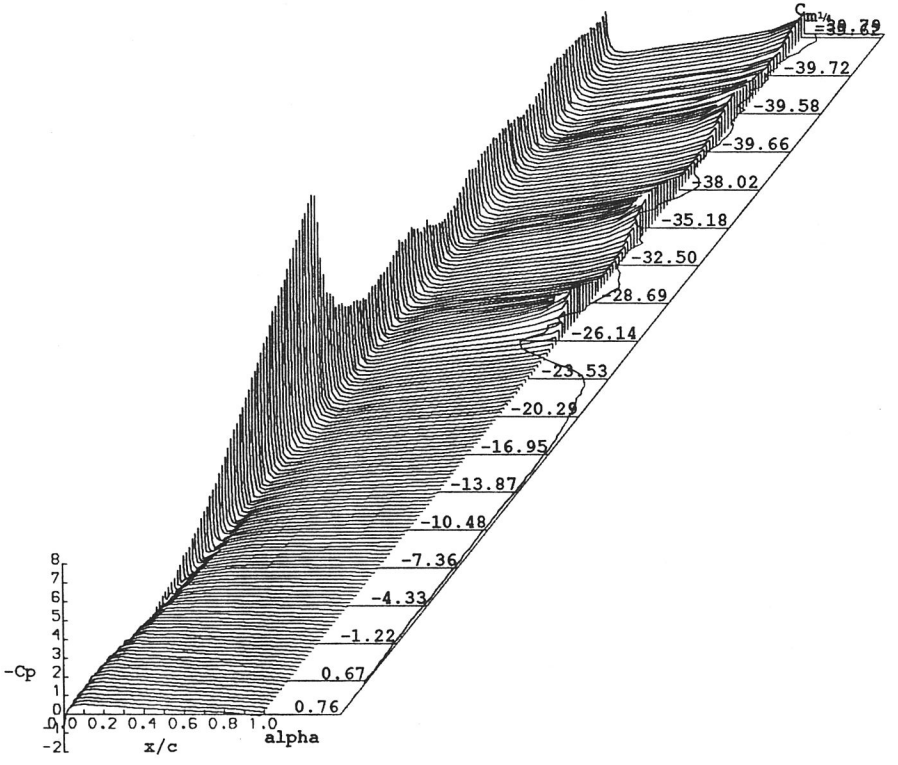


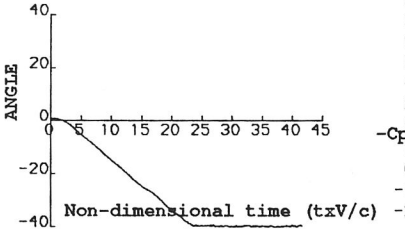


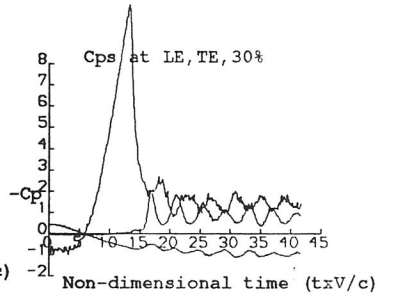
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

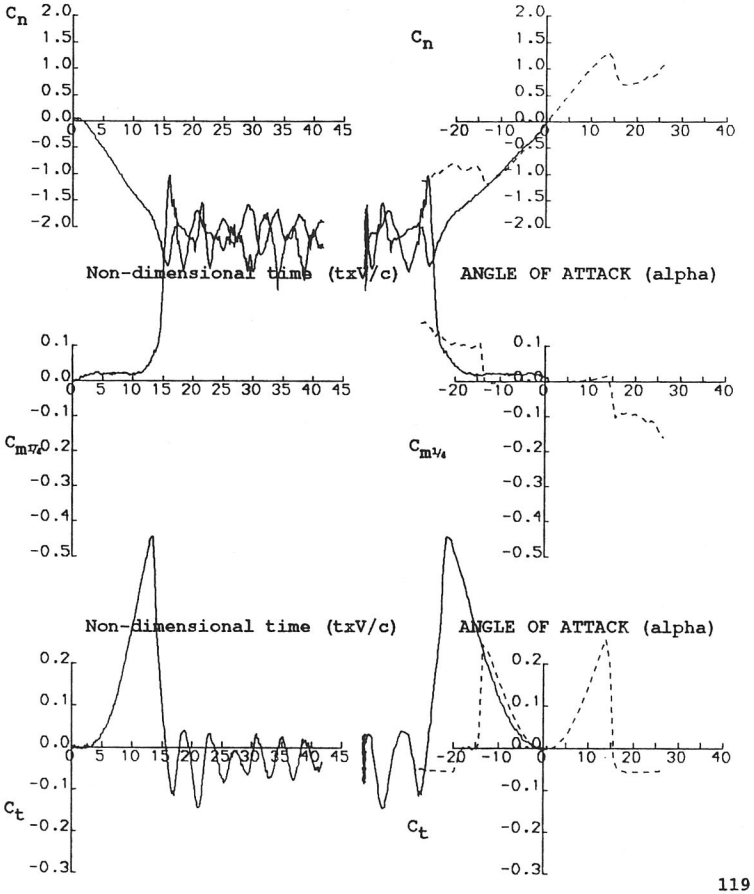
RUN REFERENCE NUMBER: 621191
REYNOLDS NUMBER = 1449568.
DYNAMIC PRESSURE = 972.55 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 28.0°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = -0.01735
LINEAR PITCH RATE = -146.61°S^{-1}





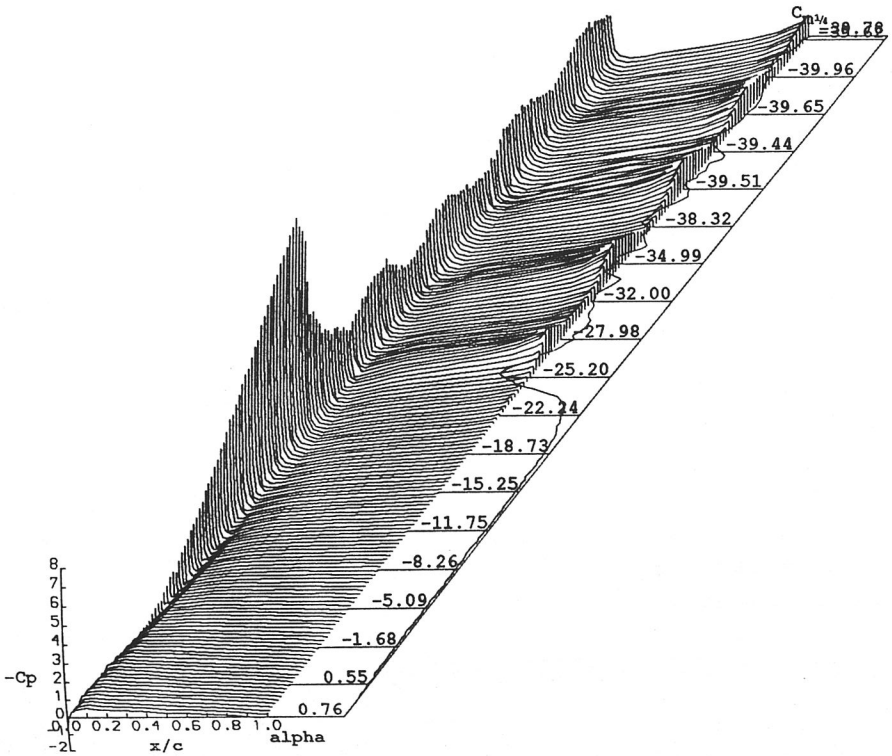


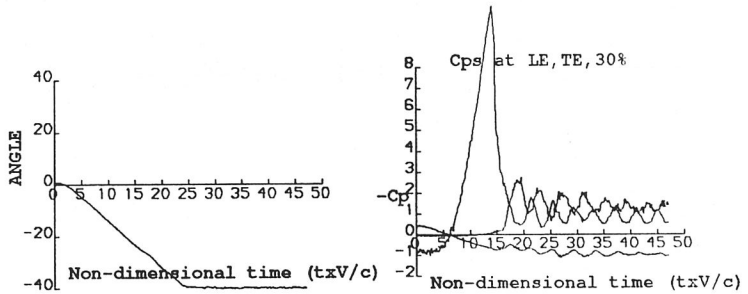


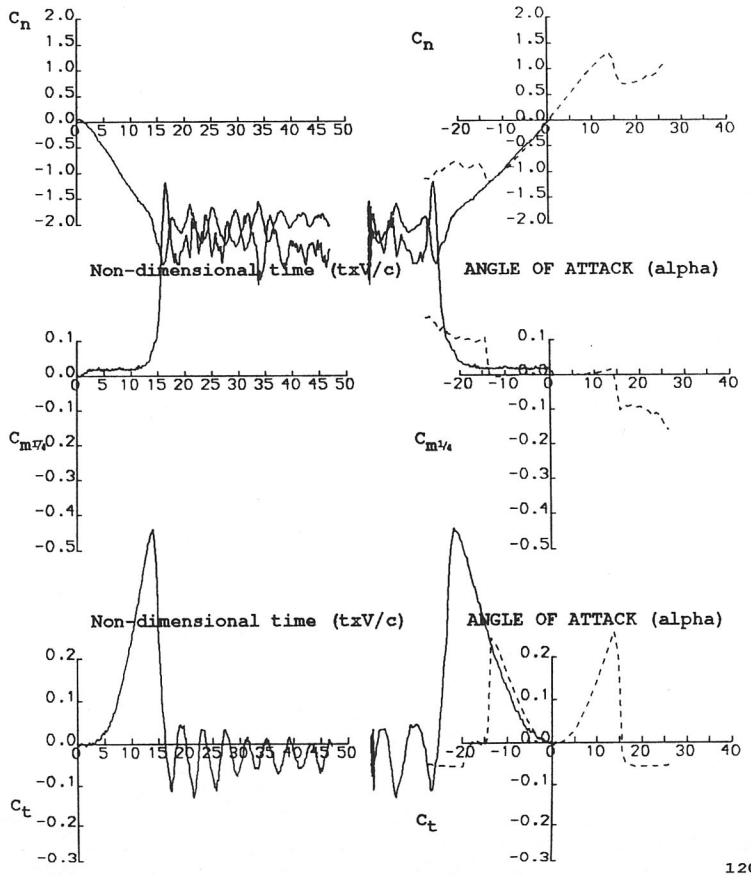
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621201
REYNOLDS NUMBER = 1442212.
DYNAMIC PRESSURE = 972.55 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 29.2°C
SAMPLING FREQUENCY = 400.00 Hz.
REDUCED PITCH RATE = -0.01649
LINEAR PITCH RATE = -139.60°S^{-1}



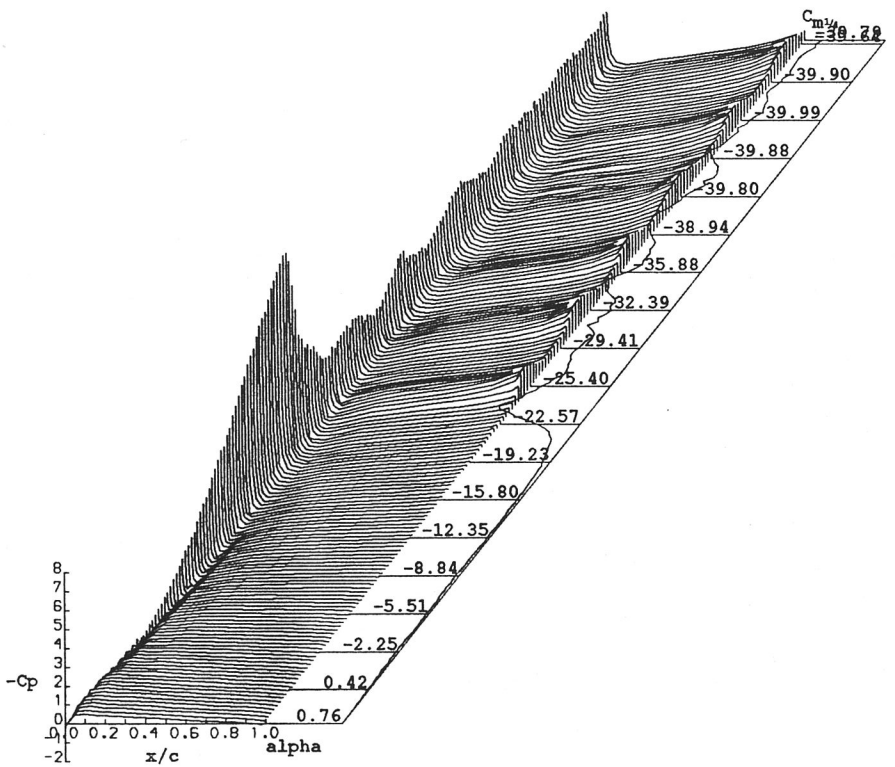


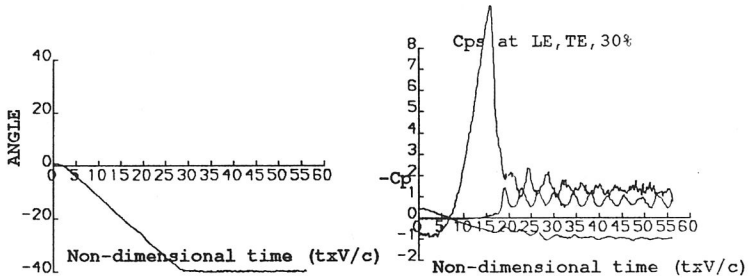


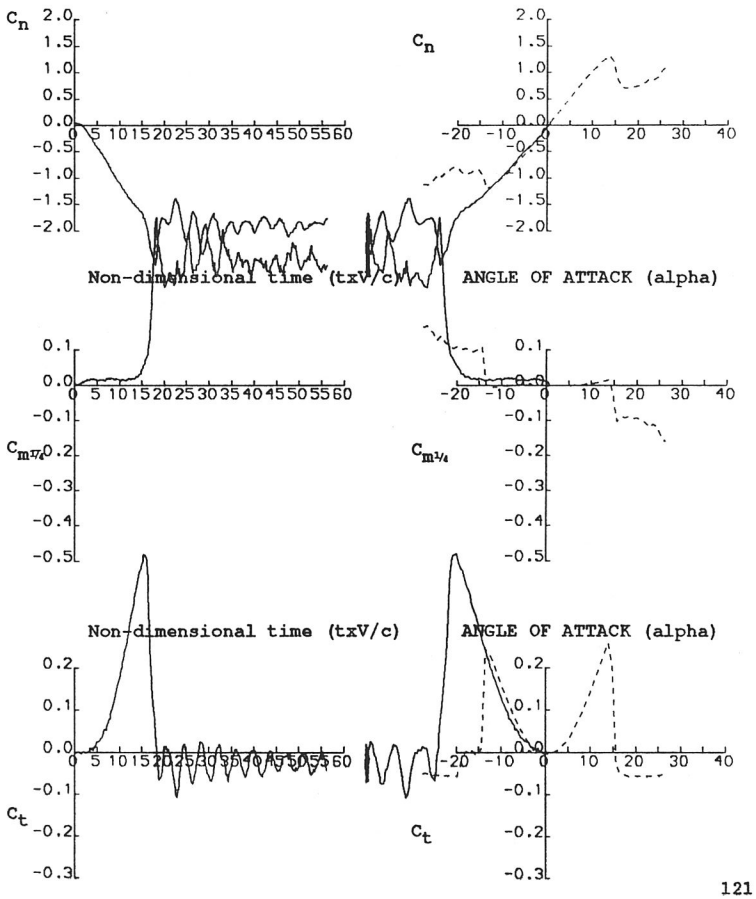
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621211
REYNOLDS NUMBER = 1440384.
DYNAMIC PRESSURE = 972.55 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 29.5°C
SAMPLING FREQUENCY = 335.01 Hz.
REDUCED PITCH RATE = -0.01372
LINEAR PITCH RATE = -116.24°S^{-1}



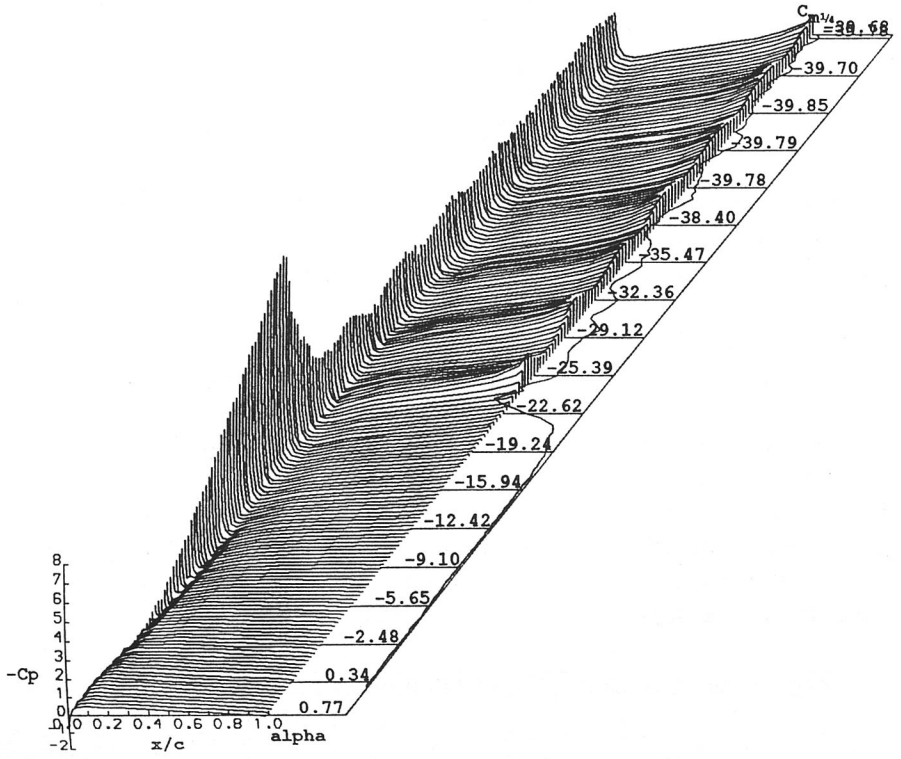


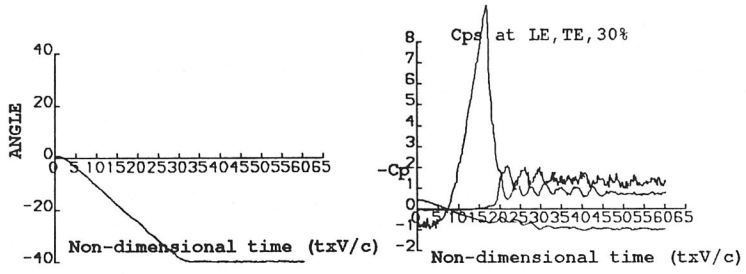


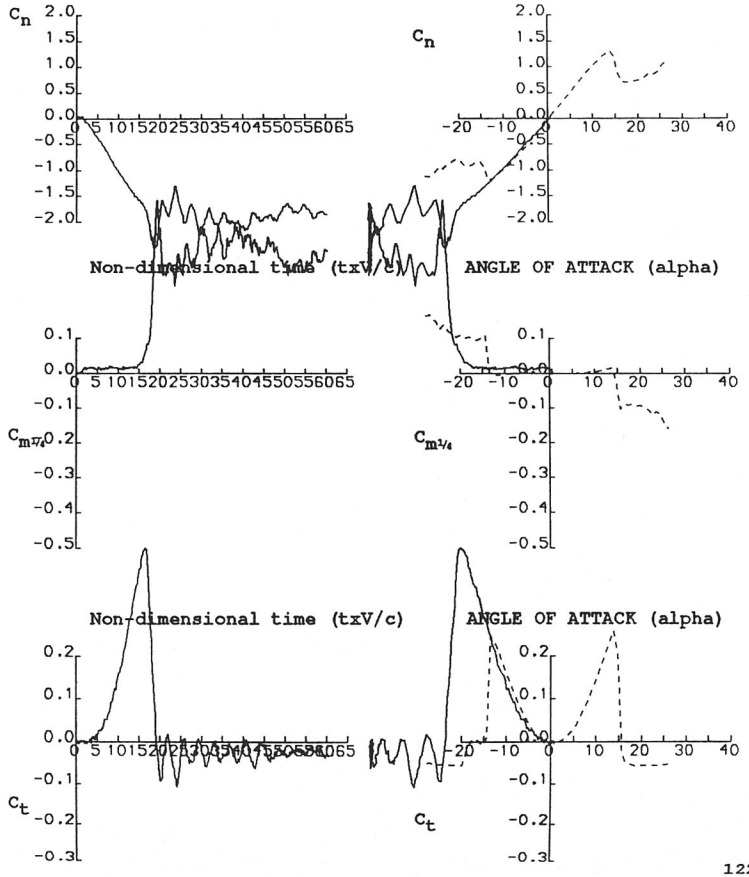
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 621221
REYNOLDS NUMBER = 1439167.
DYNAMIC PRESSURE = 972.55 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 29.7°C
SAMPLING FREQUENCY = 312.01 Hz.
REDUCED PITCH RATE = -0.01261
LINEAR PITCH RATE = -106.84°S^{-1}



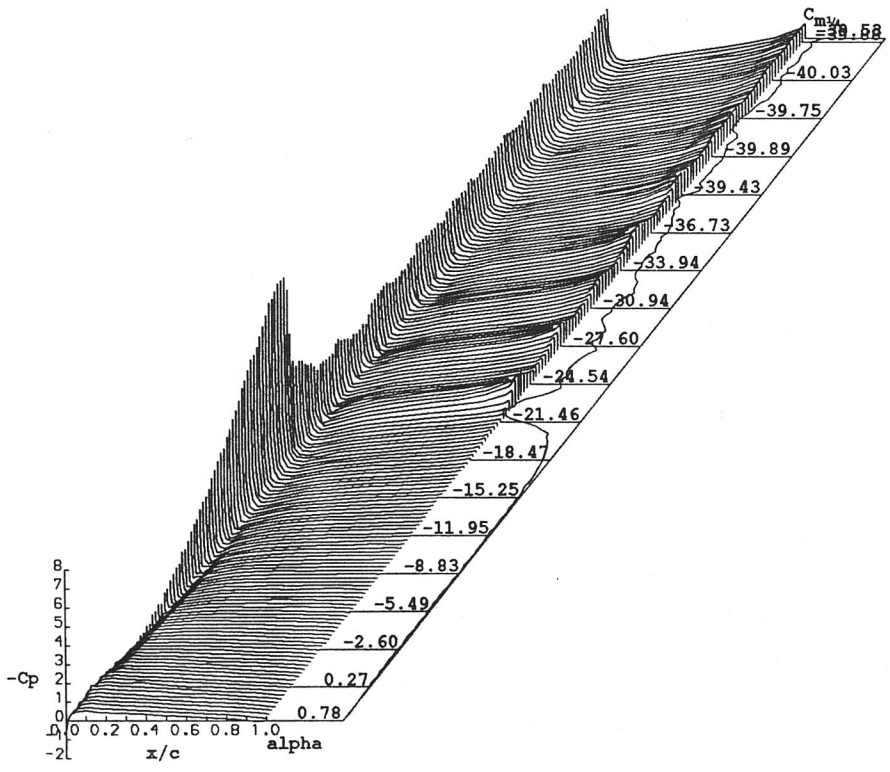


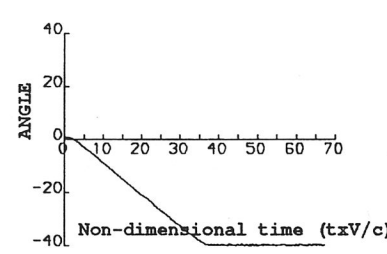


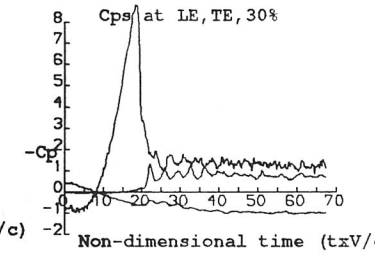
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

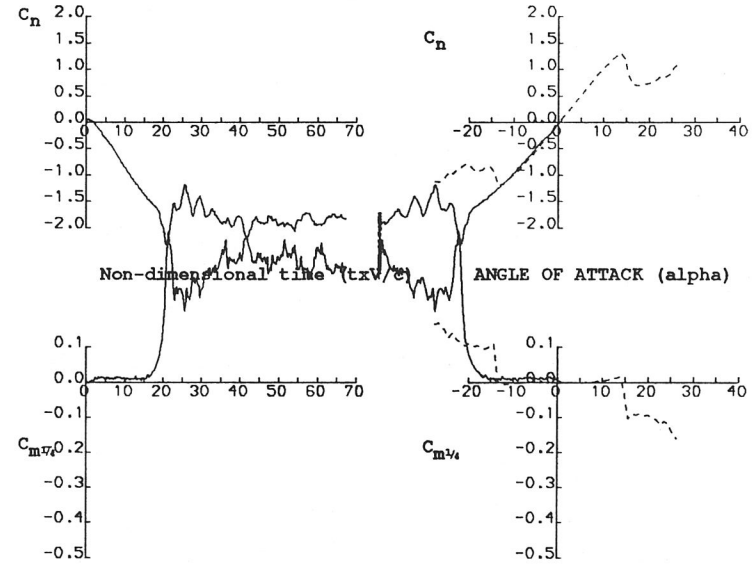
RUN REFERENCE NUMBER: 621231
REYNOLDS NUMBER = 1446578.
DYNAMIC PRESSURE = 978.44 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

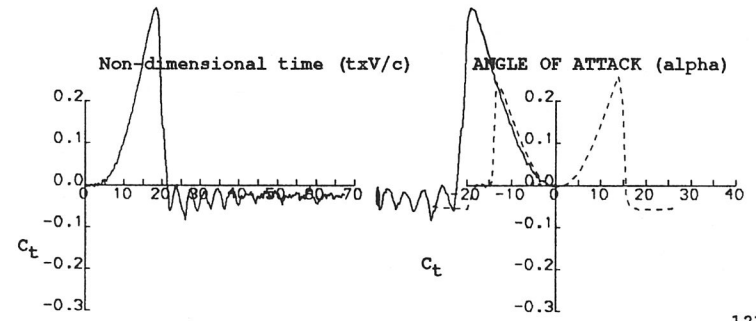
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 29.2°C
SAMPLING FREQUENCY = 280.03 Hz.
REDUCED PITCH RATE = -0.01065
LINEAR PITCH RATE = $-90.43°S^{-1}$







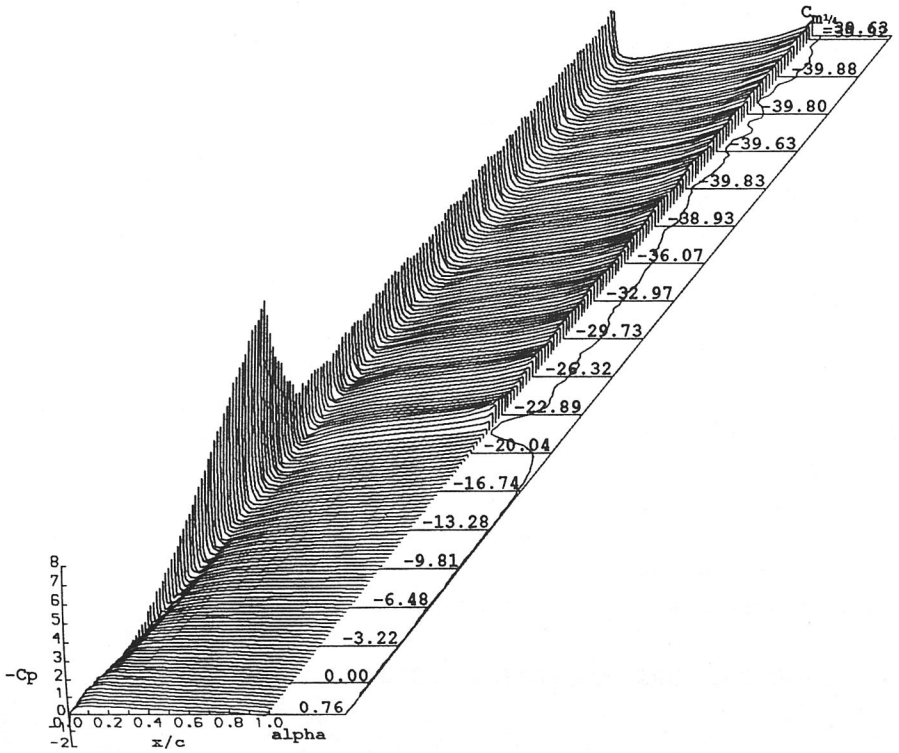


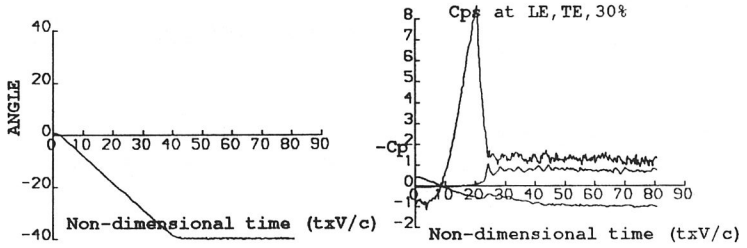


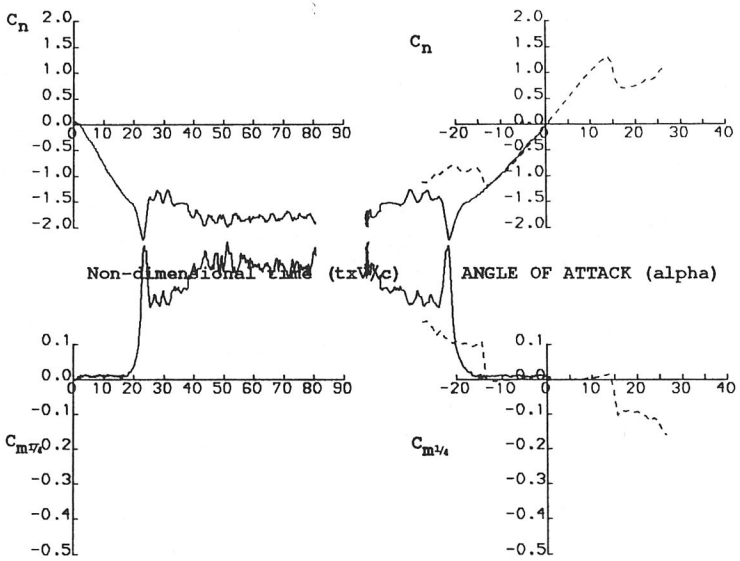
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

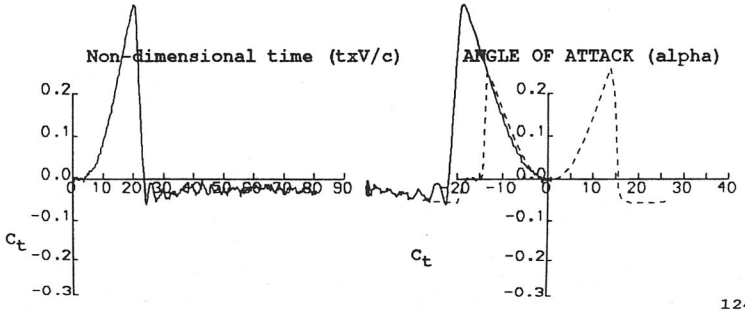
RUN REFERENCE NUMBER: 621241
REYNOLDS NUMBER = 1442916.
DYNAMIC PRESSURE = 978.44 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 29.8°C
SAMPLING FREQUENCY = 233.97 Hz.
REDUCED PITCH RATE = -0.00936
LINEAR PITCH RATE = $-79.53°S^{-1}$





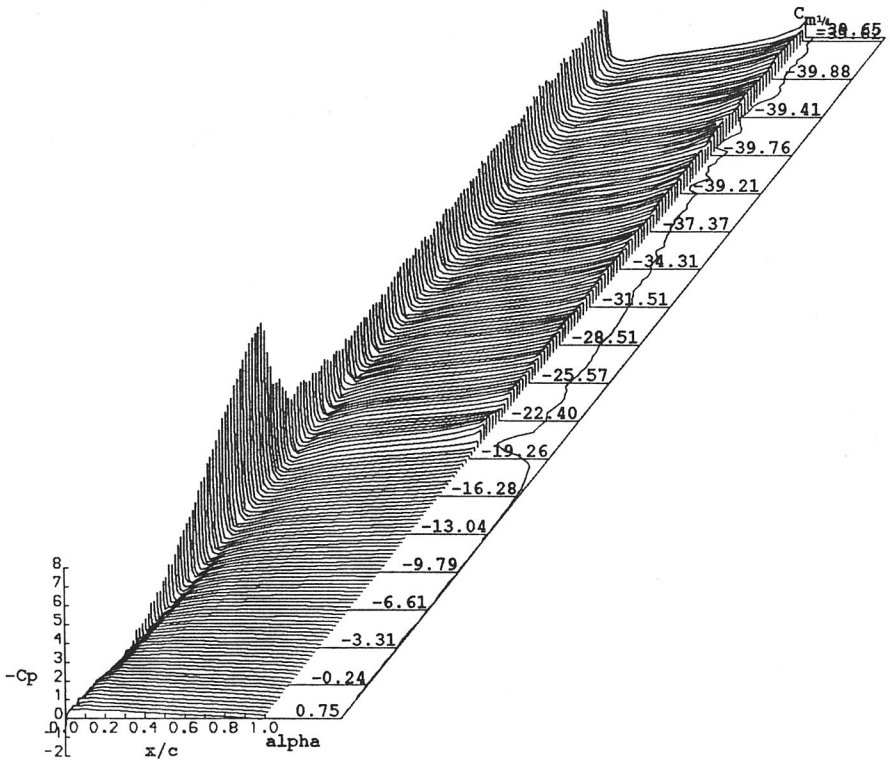


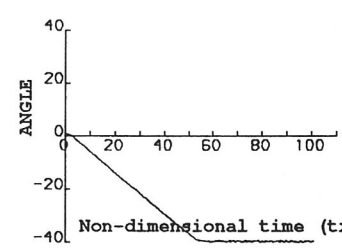


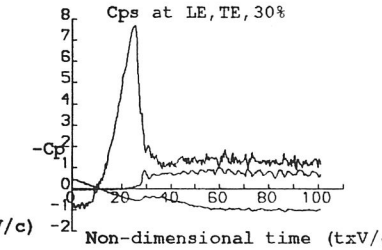
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

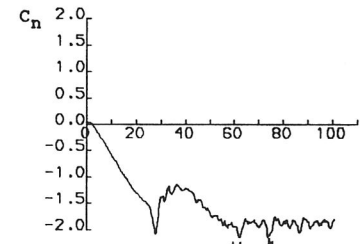
RUN REFERENCE NUMBER: 621251
REYNOLDS NUMBER = 1441091.
DYNAMIC PRESSURE = 978.44 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

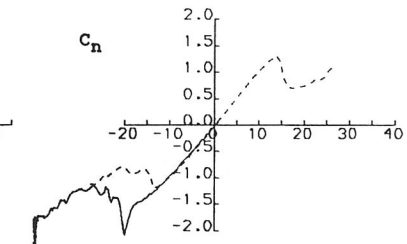
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 30.1°C
SAMPLING FREQUENCY = 186.99 Hz.
REDUCED PITCH RATE = -0.00677
LINEAR PITCH RATE = $-57.58°S^{-1}$

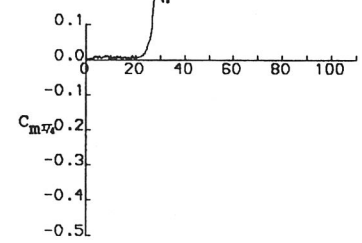


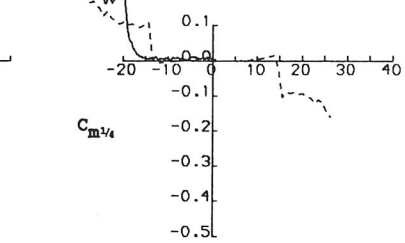


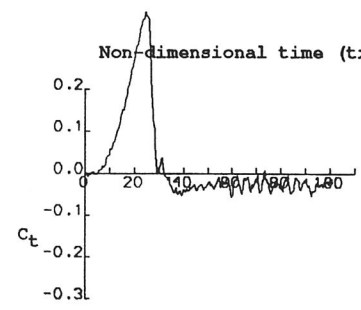


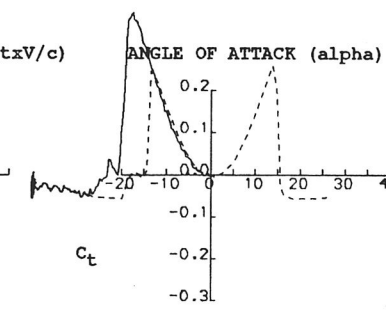








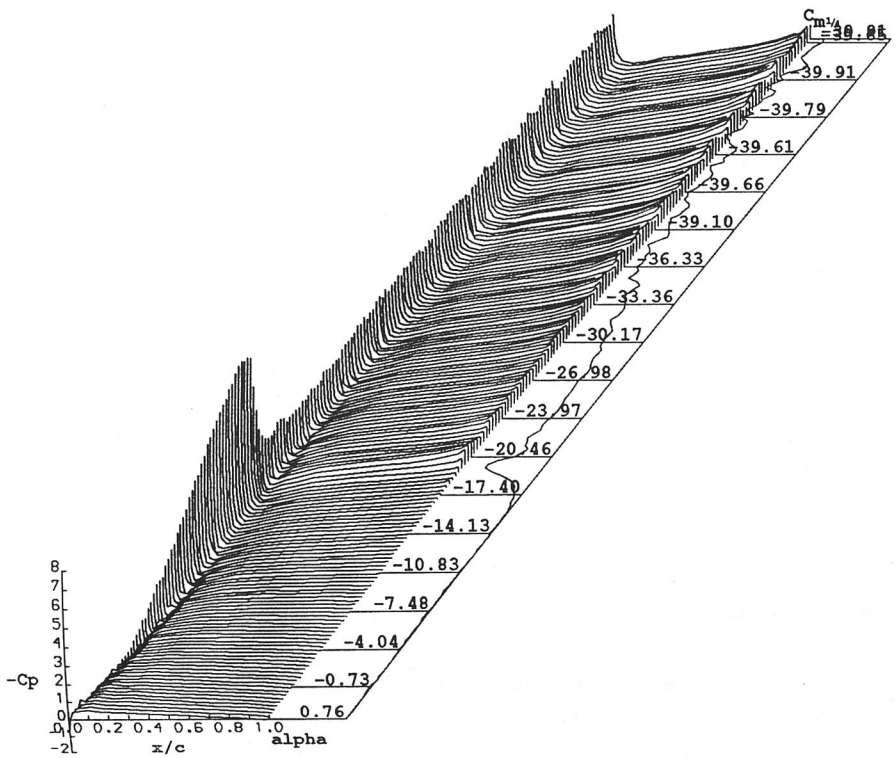


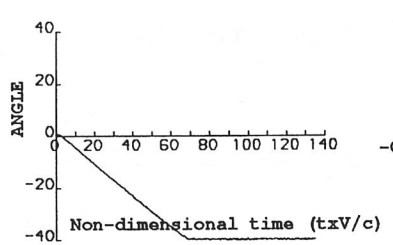


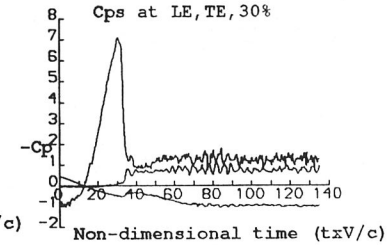
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

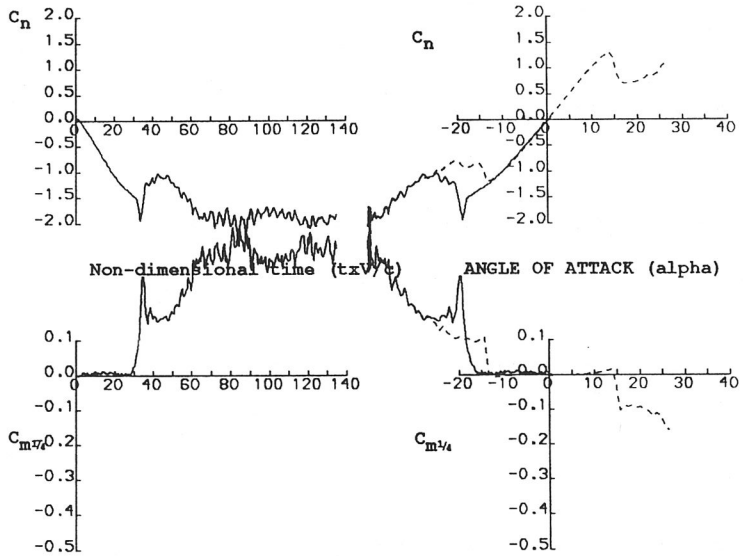
RUN REFERENCE NUMBER: 621261
REYNOLDS NUMBER = 1440483.
DYNAMIC PRESSURE = 978.44 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

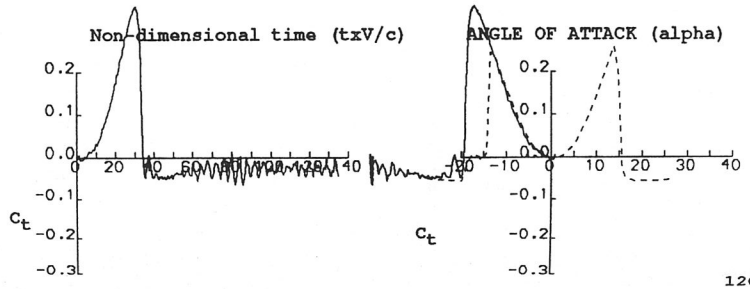
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 30.2°C
SAMPLING FREQUENCY = 140.00 Hz.
REDUCED PITCH RATE = -0.00528
LINEAR PITCH RATE = -44.88°S^{-1}







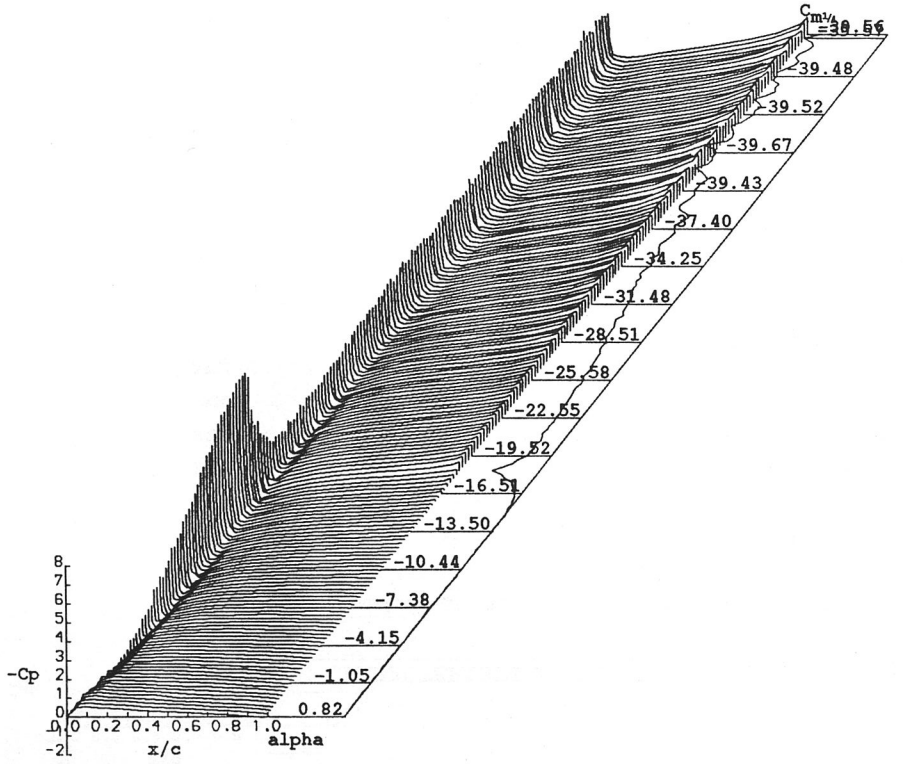


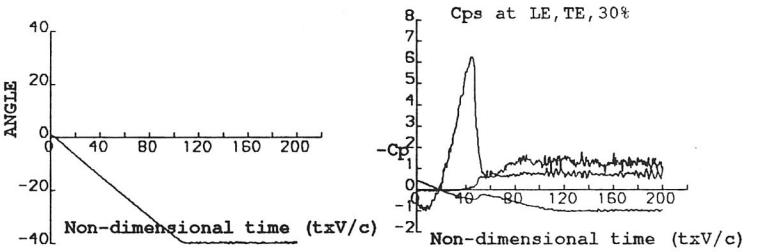


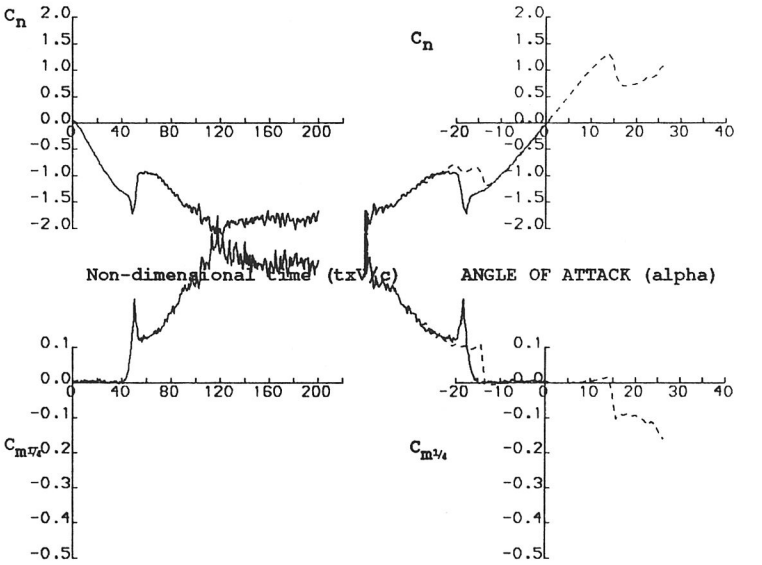
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

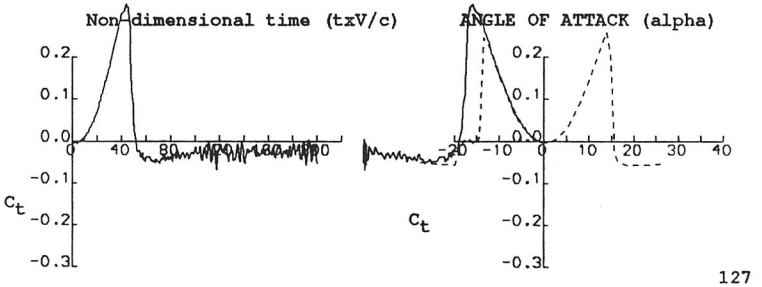
RUN REFERENCE NUMBER: 621271
REYNOLDS NUMBER = 1431850.
DYNAMIC PRESSURE = 965.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.116
AIR TEMPERATURE = 30.0°C
SAMPLING FREQUENCY = 93.70 Hz.
REDUCED PITCH RATE = -0.00338
LINEAR PITCH RATE = $-28.56°S^{-1}$





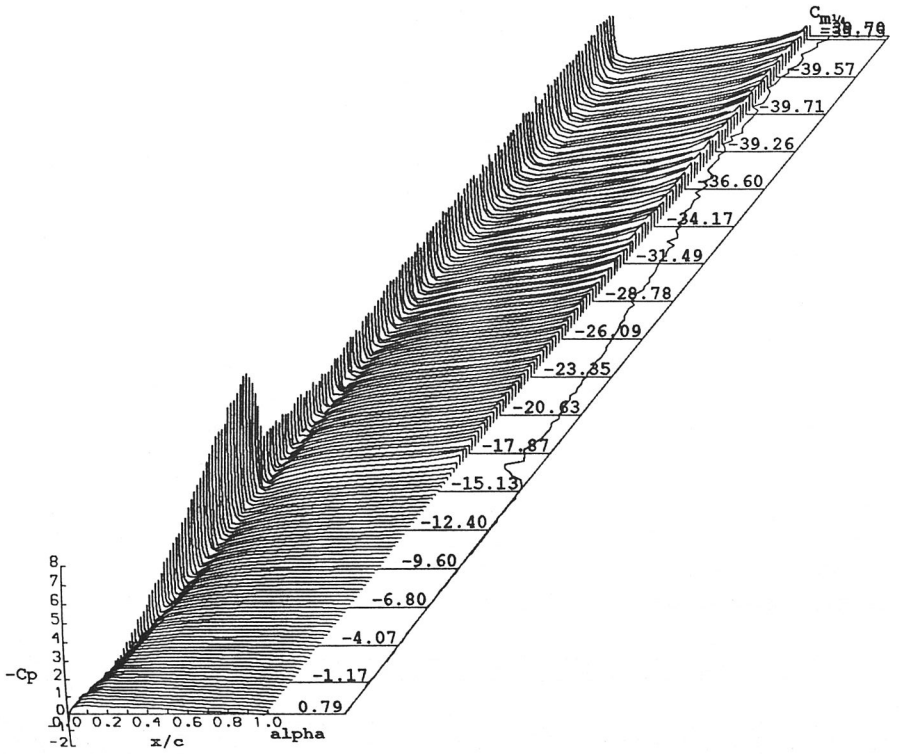


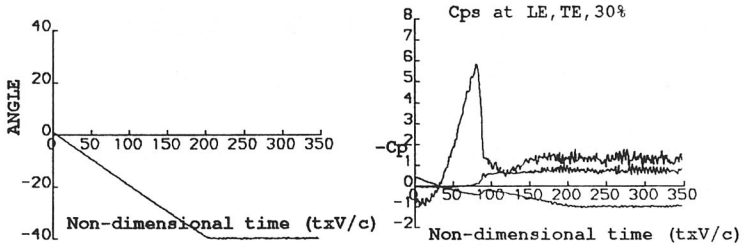


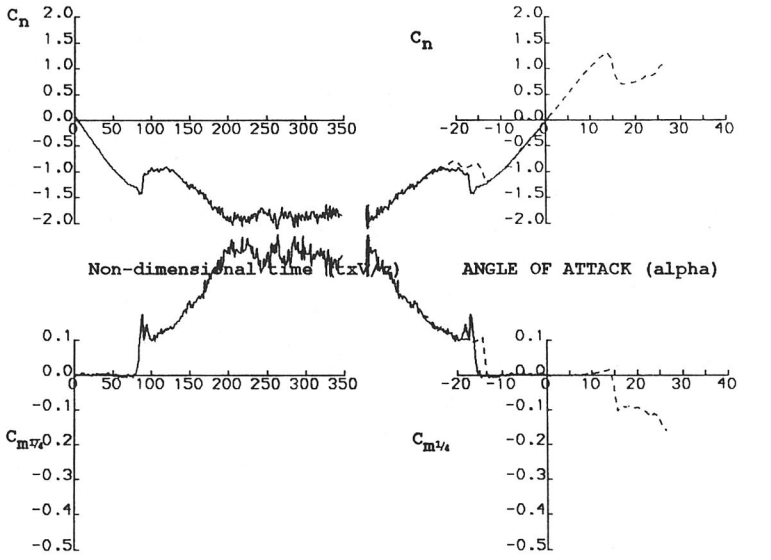
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

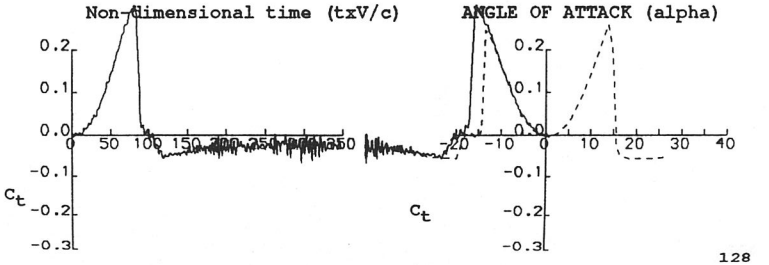
RUN REFERENCE NUMBER: 621281
REYNOLDS NUMBER = 1430041.
DYNAMIC PRESSURE = 965.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.116
AIR TEMPERATURE = 30.3°C
SAMPLING FREQUENCY = 54.10 Hz.
REDUCED PITCH RATE = -0.00175
LINEAR PITCH RATE = $-14.80°S^{-1}$





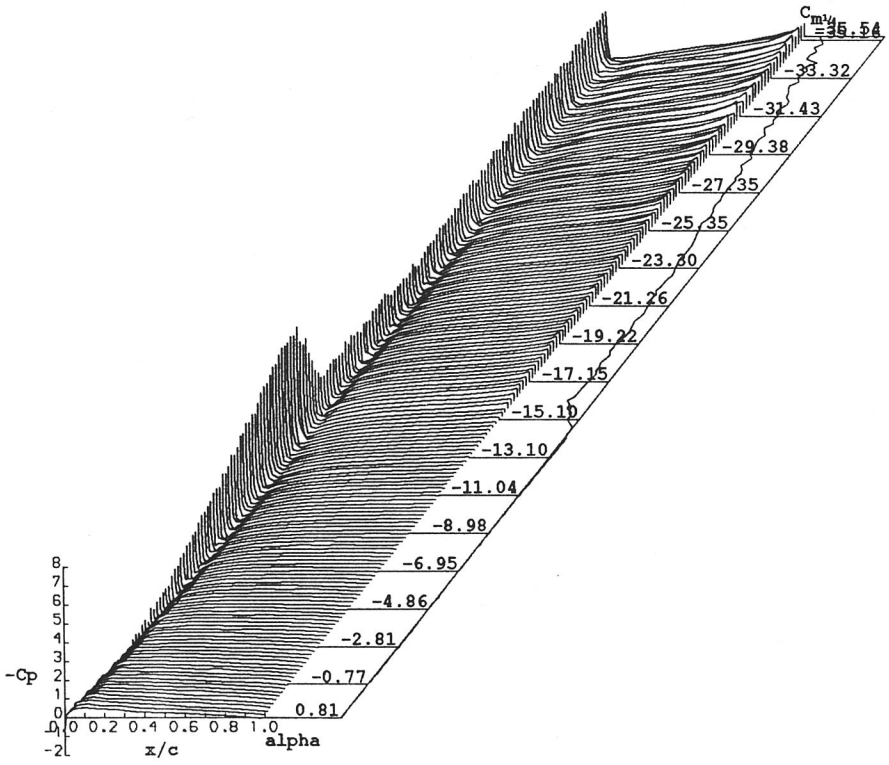


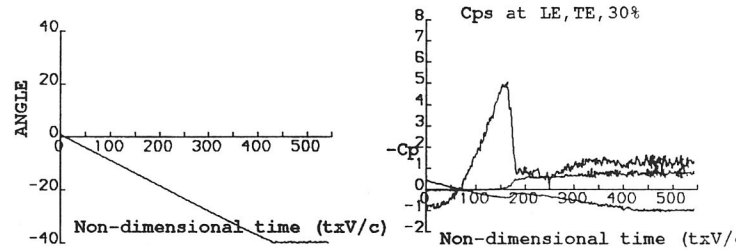


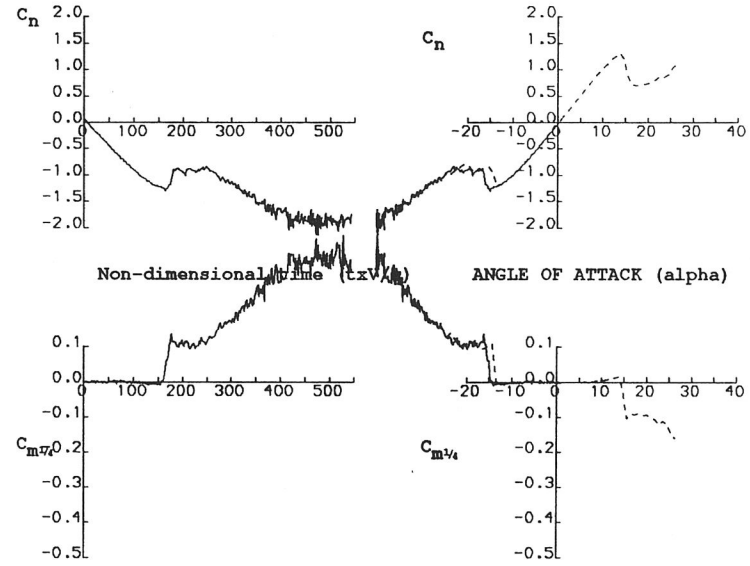
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

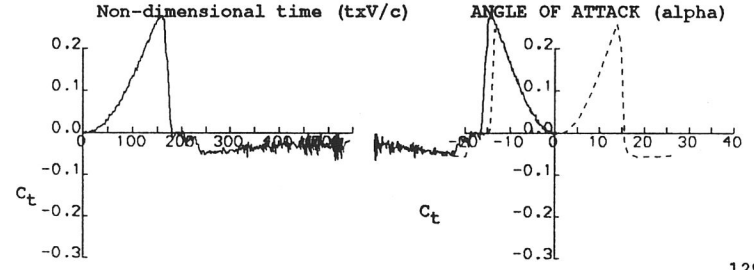
RUN REFERENCE NUMBER: 621291
REYNOLDS NUMBER = 1423261.
DYNAMIC PRESSURE = 953.58 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.115
AIR TEMPERATURE = 30.0°C
SAMPLING FREQUENCY = 34.30 Hz.
REDUCED PITCH RATE = -0.00084
LINEAR PITCH RATE = $-7.05°S^{-1}$





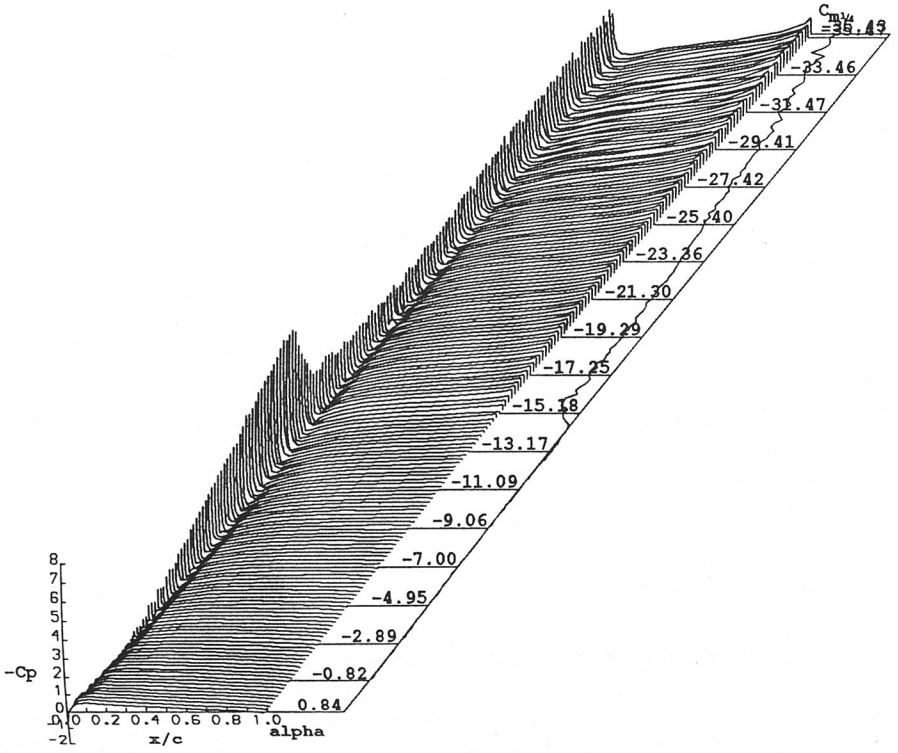


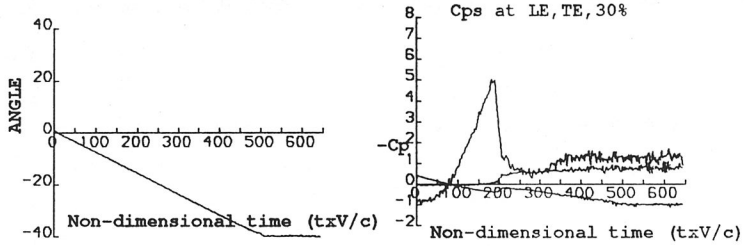


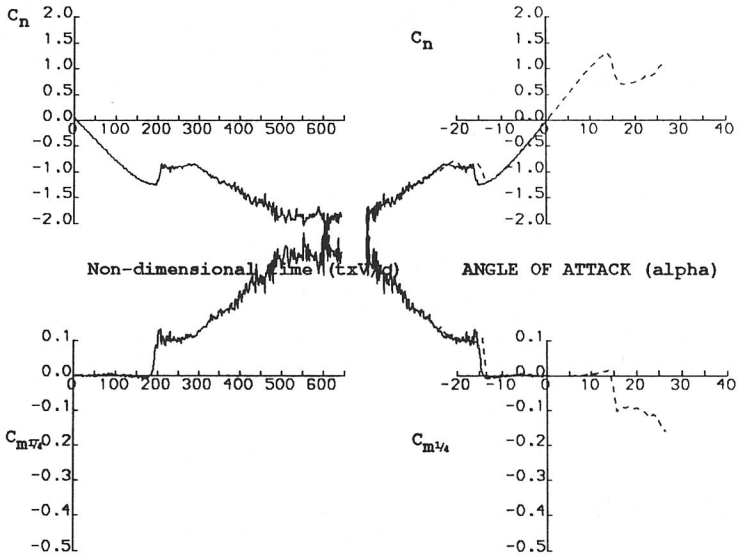
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

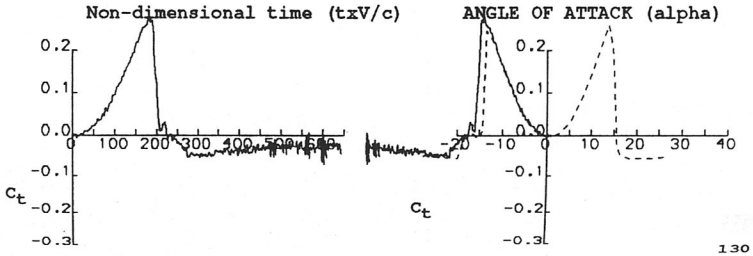
RUN REFERENCE NUMBER: 621301
REYNOLDS NUMBER = 1420864.
DYNAMIC PRESSURE = 953.58 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.115
AIR TEMPERATURE = 30.4°C
SAMPLING FREQUENCY = 29.00 Hz.
REDUCED PITCH RATE = -0.00071
LINEAR PITCH RATE = $-5.95°S^{-1}$





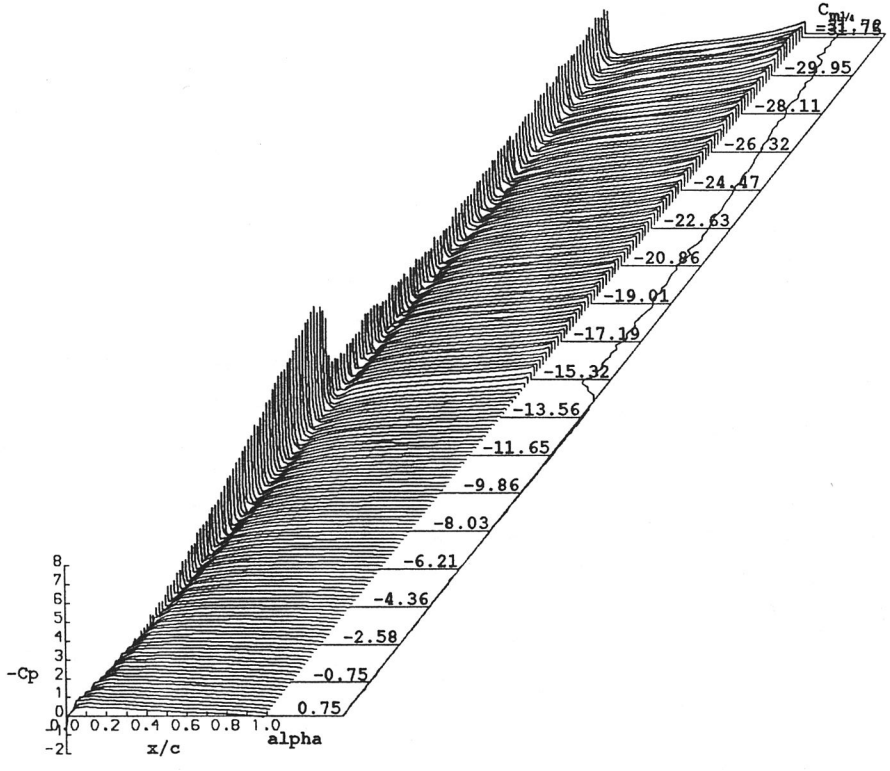


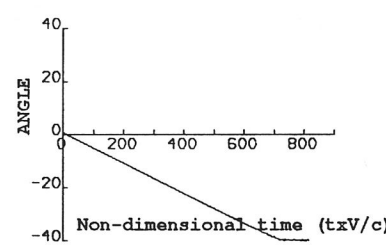


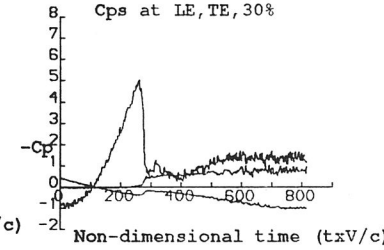
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

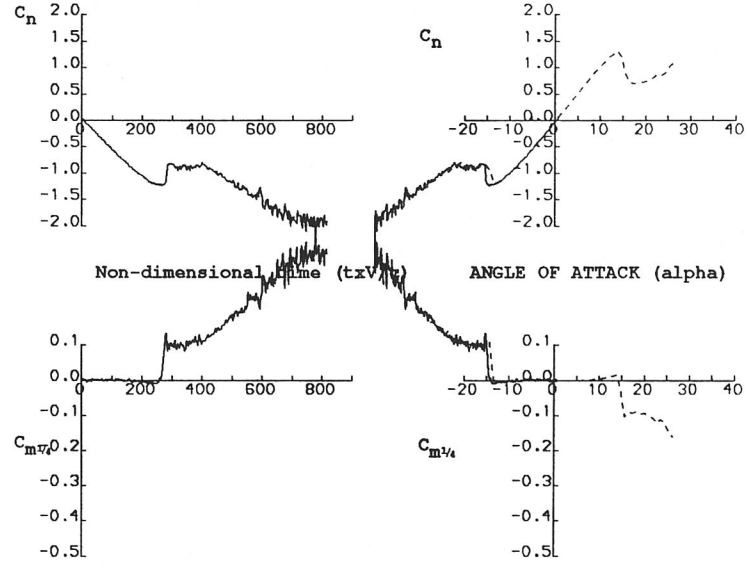
RUN REFERENCE NUMBER: 621311
REYNOLDS NUMBER = 1430791.
DYNAMIC PRESSURE = 964.51 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

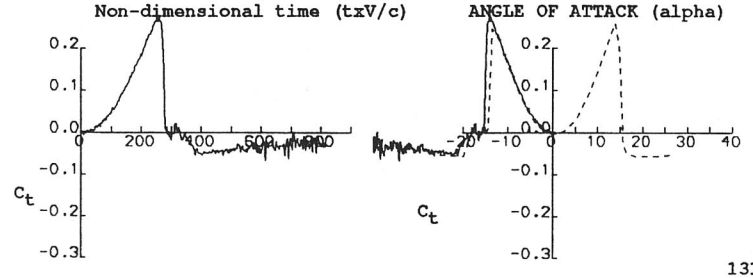
DATE OF TEST: 19/12/90
MACH NUMBER = 0.116
AIR TEMPERATURE = 30.1°C
SAMPLING FREQUENCY = 23.00 Hz.
REDUCED PITCH RATE = -0.00050
LINEAR PITCH RATE = $-4.23°S^{-1}$







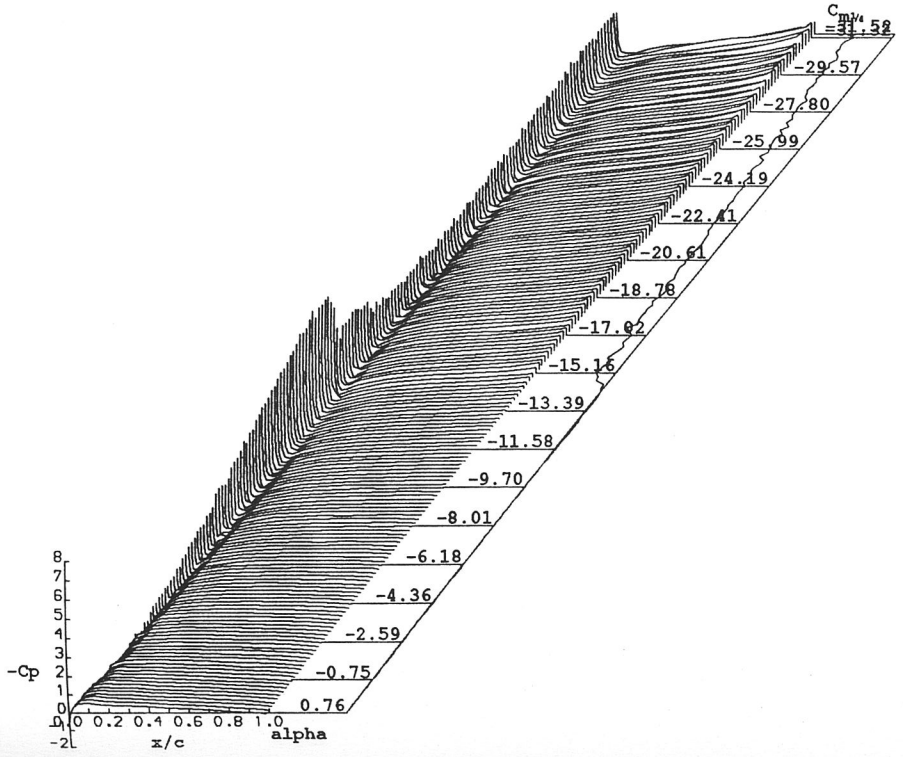


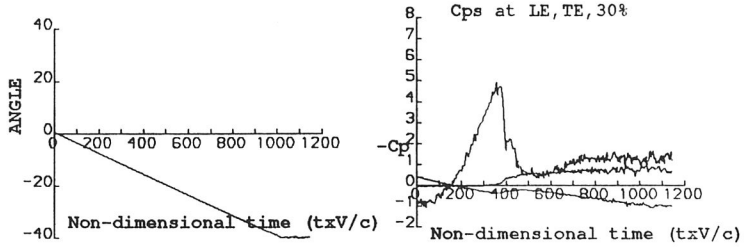


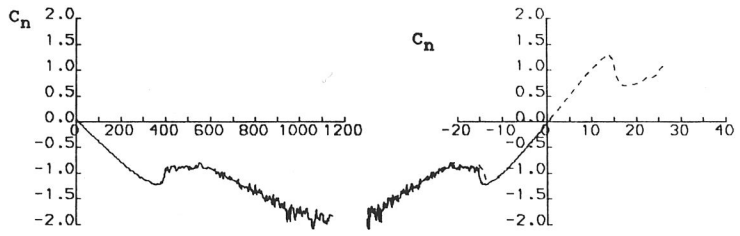
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

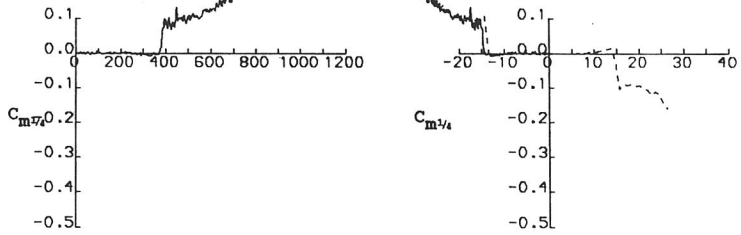
RUN REFERENCE NUMBER: 621321
REYNOLDS NUMBER = 1428983.
DYNAMIC PRESSURE = 964.51 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

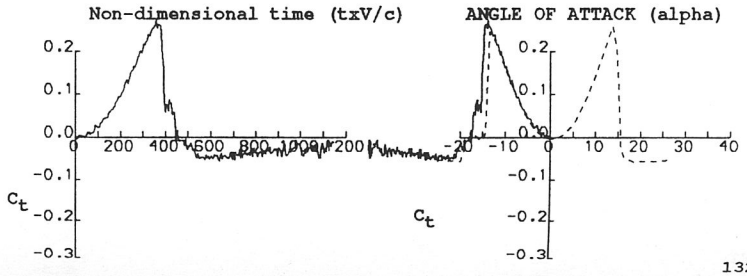
DATE OF TEST: 19/12/90
MACH NUMBER = 0.116
AIR TEMPERATURE = 30.4°C
SAMPLING FREQUENCY = 16.40 Hz.
REDUCED PITCH RATE = -0.00035
LINEAR PITCH RATE = $-2.96°S^{-1}$







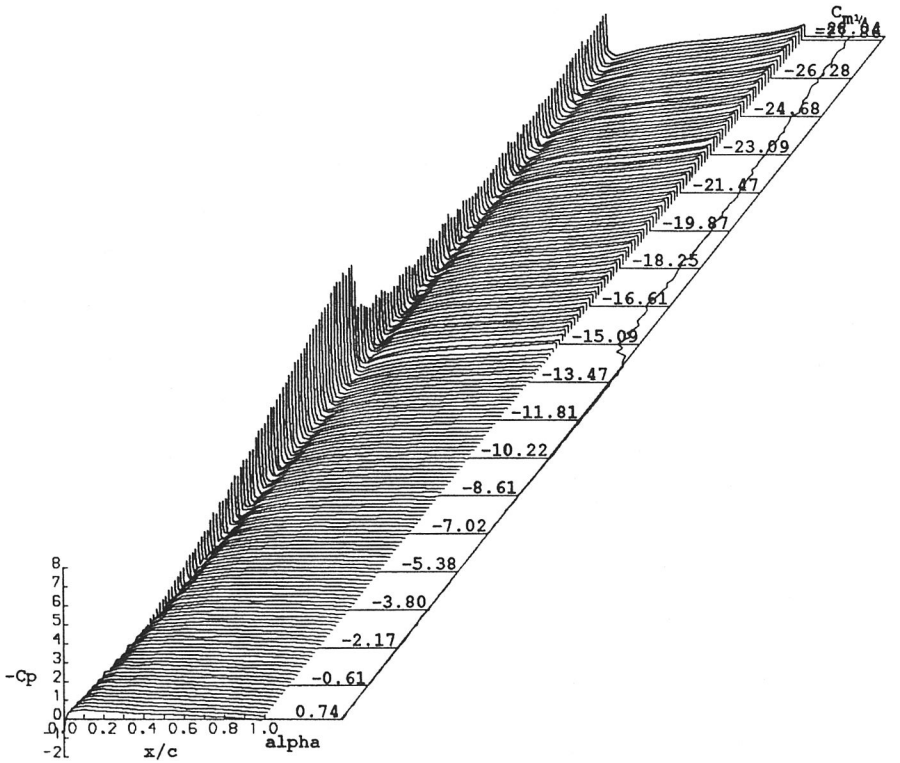


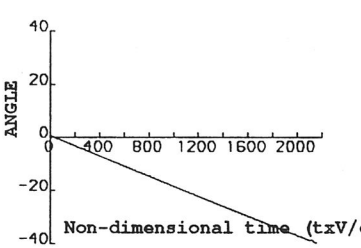


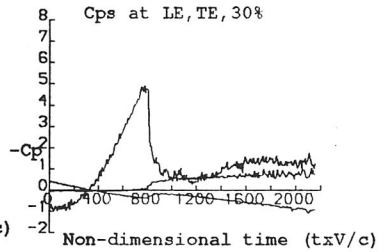
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

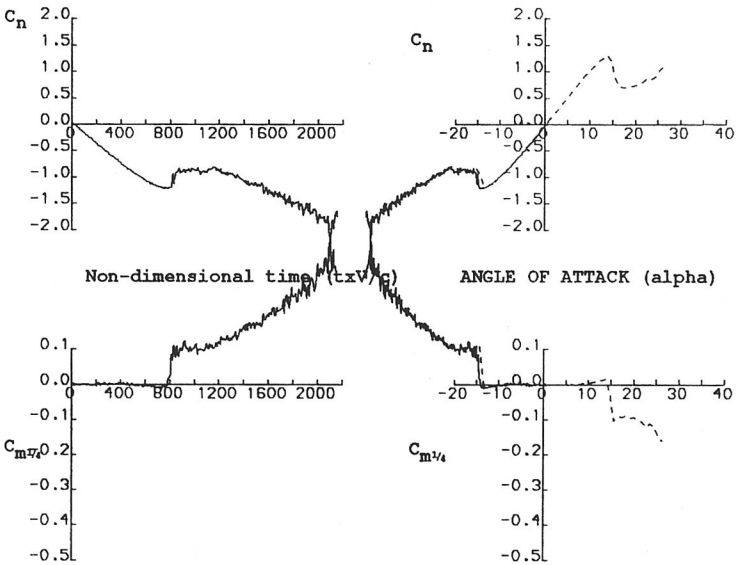
RUN REFERENCE NUMBER: 621331
REYNOLDS NUMBER = 1427180.
DYNAMIC PRESSURE = 964.51 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP UP
START ANGLE = 1.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

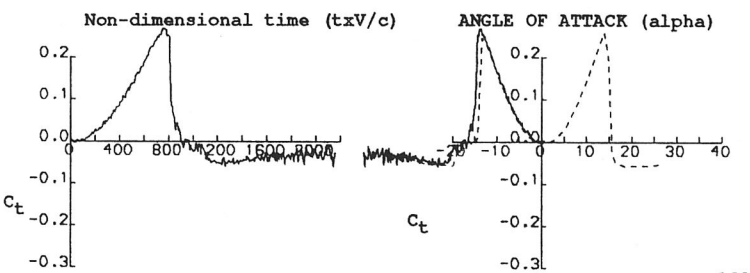
DATE OF TEST: 19/12/90
MACH NUMBER = 0.116
AIR TEMPERATURE = 30.7°C
SAMPLING FREQUENCY = 8.70 Hz.
REDUCED PITCH RATE = -0.00016
LINEAR PITCH RATE = $-1.39°S^{-1}$











G.U. Aero Report 9207

UNIVERSITY OF GLASGOW

DEPARTMENT OF AEROSPACE ENGINEERING

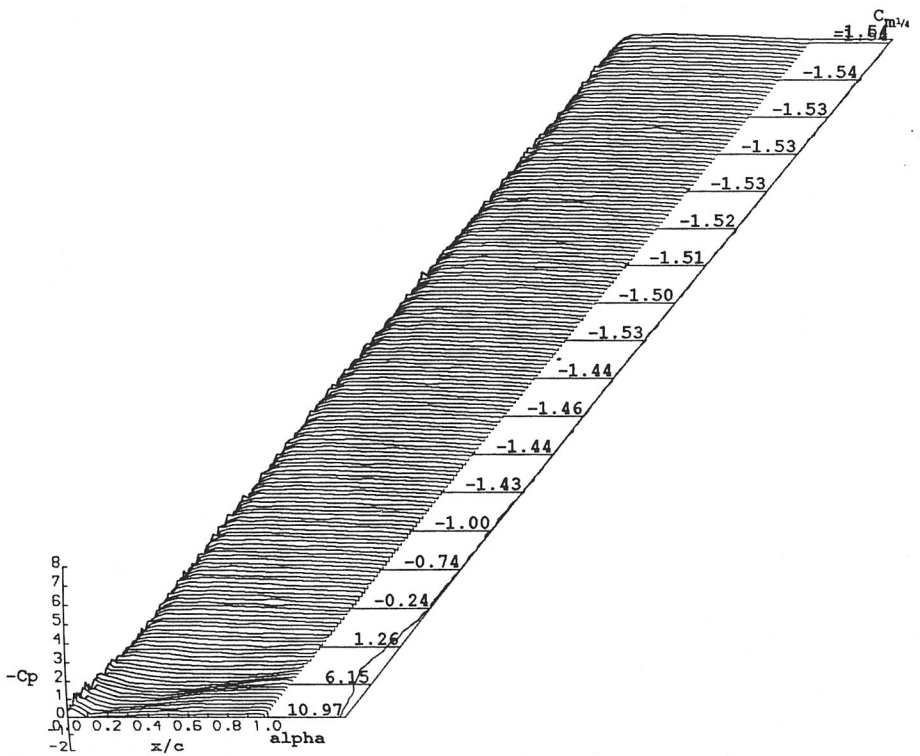
PRESSURE DATA FROM

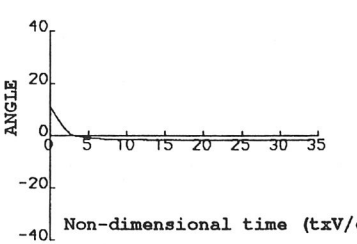
RAMP DOWN EXPERIMENTS

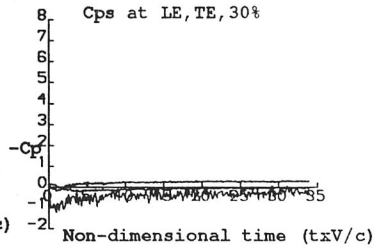
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

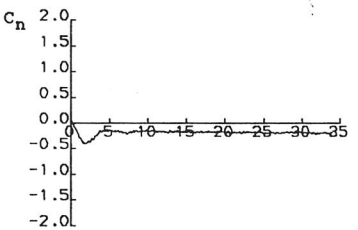
RUN REFERENCE NUMBER: 30381
REYNOLDS NUMBER = 1496452.
DYNAMIC PRESSURE = 986.39 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

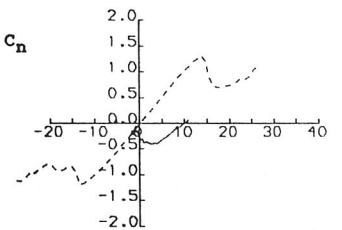
DATE OF TEST: 17/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 22.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03911
LINEAR PITCH RATE = $-329.13°S^{-1}$

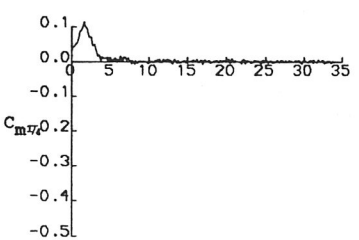


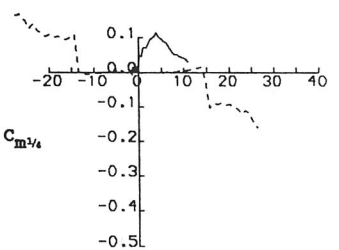


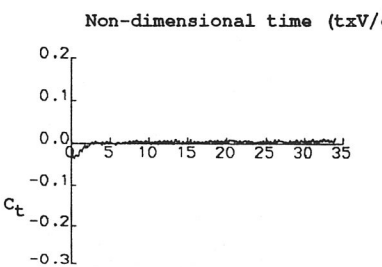


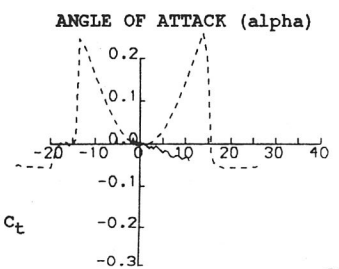






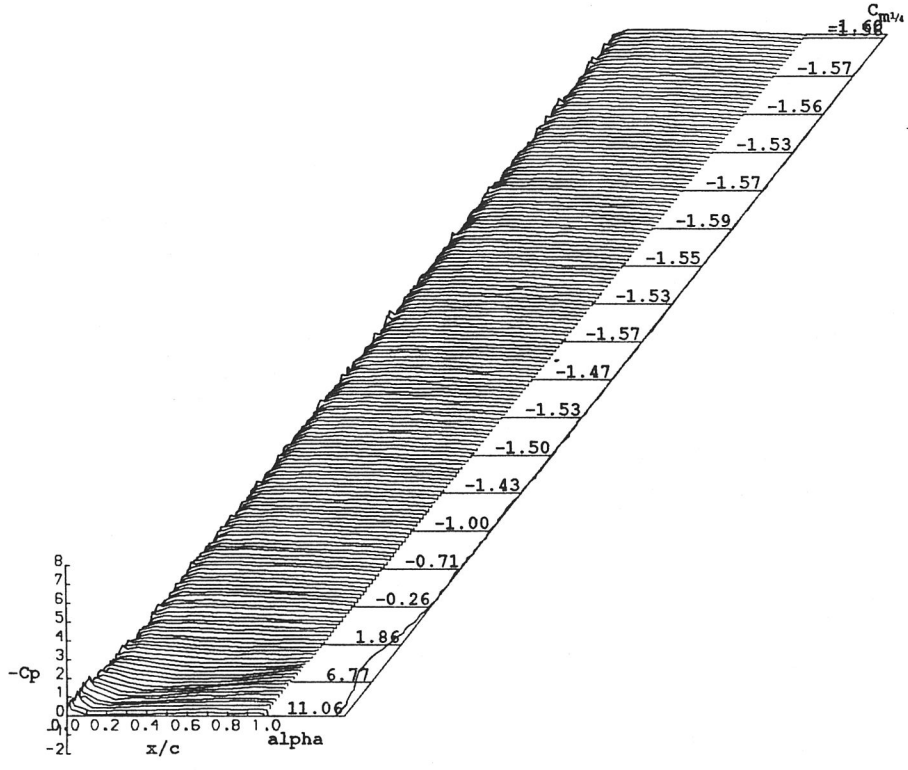


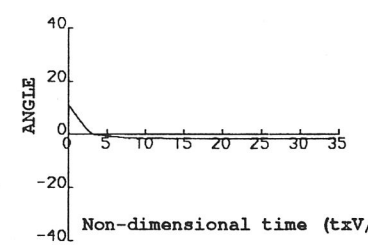


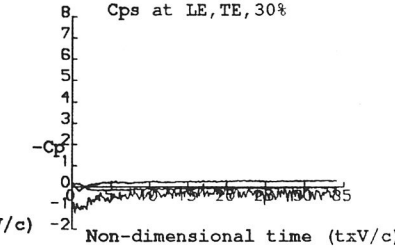


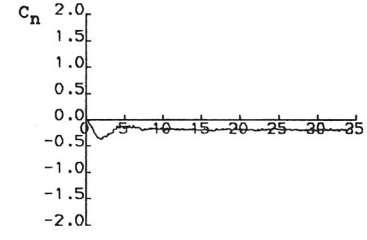
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

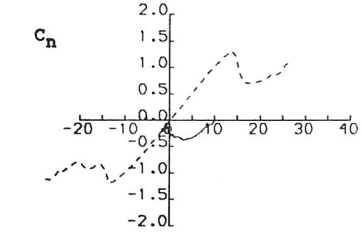
RUN REFERENCE NUMBER: 30391
DATE OF TEST: 17/12/90
REYNOLDS NUMBER = 1485497.
MACH NUMBER = 0.117
DYNAMIC PRESSURE = 986.39 Nm^{-2}
AIR TEMPERATURE = 24.5°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 550.05 Hz.
MOTION TYPE: RAMP DOWN
REDUCED PITCH RATE = -0.03463
START ANGLE = 40.00°
LINEAR PITCH RATE = $-292.29°S^{-1}$
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

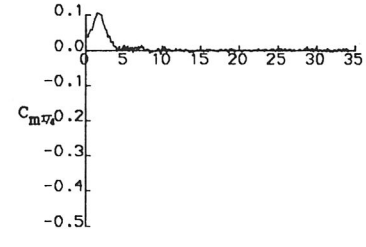


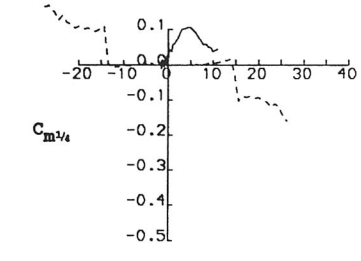


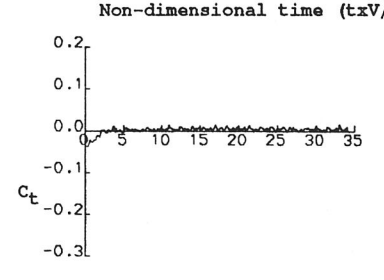


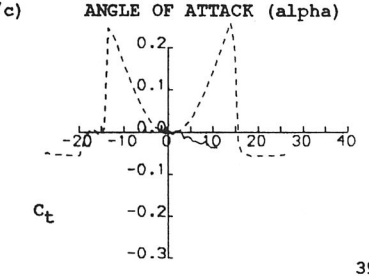








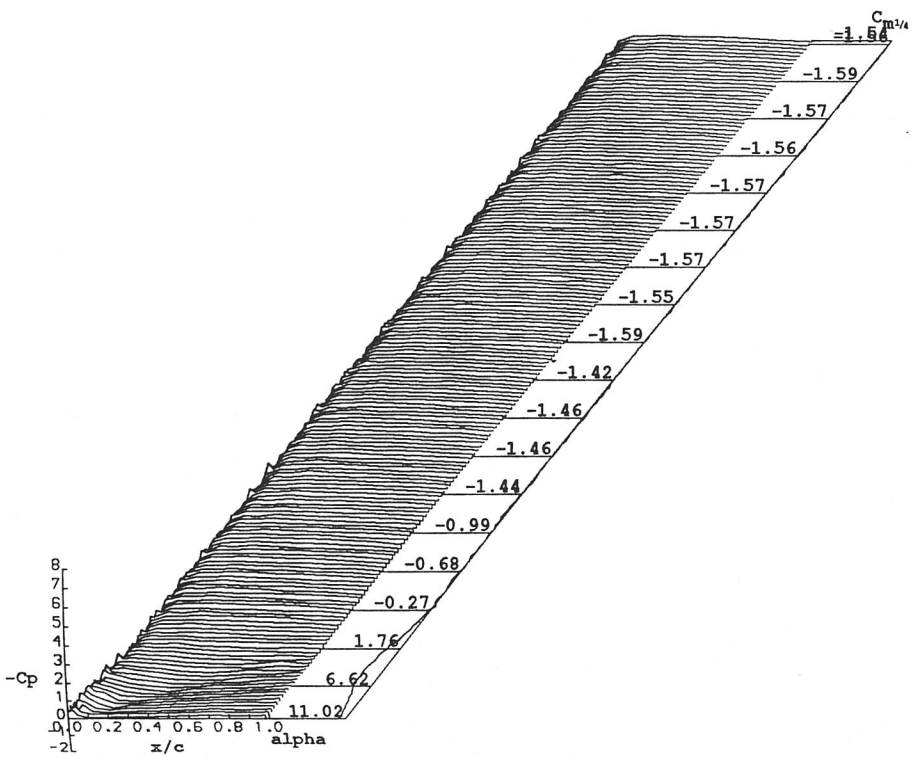


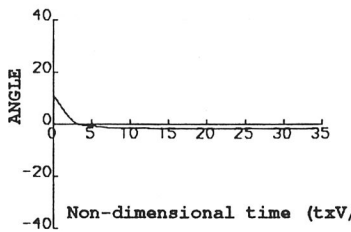


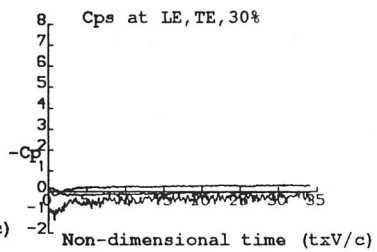
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

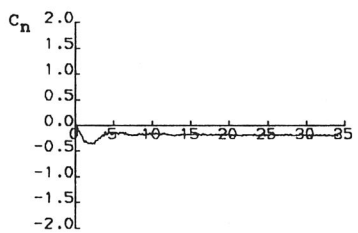
RUN REFERENCE NUMBER: 30401
REYNOLDS NUMBER = 1484219.
DYNAMIC PRESSURE = 986.39 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

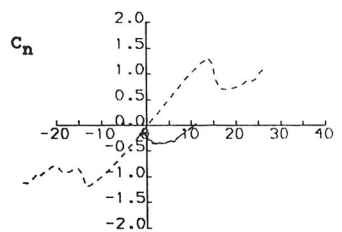
DATE OF TEST: 17/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 24.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03627
LINEAR PITCH RATE = $-306.22°S^{-1}$

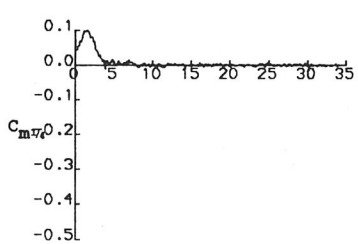


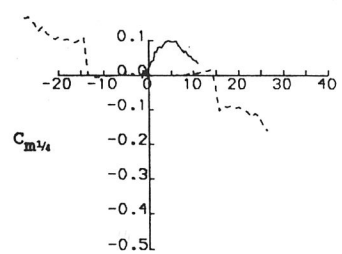






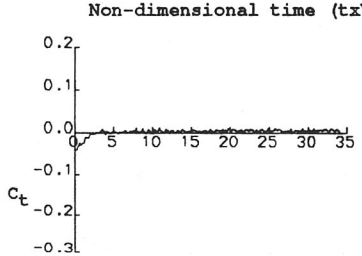


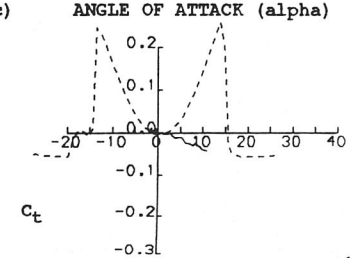




Non-dimensional time (txV/c)

ANGLE OF ATTACK (alpha)

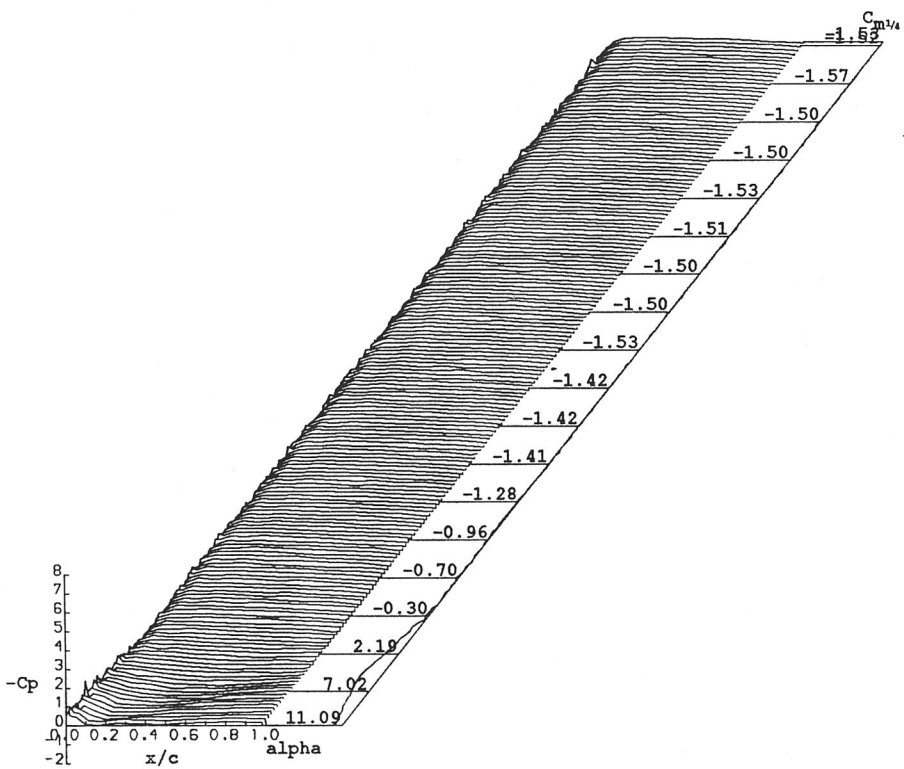


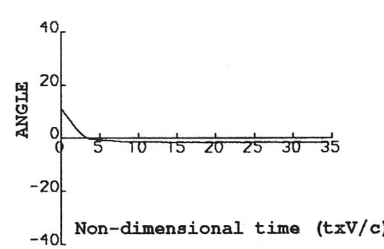


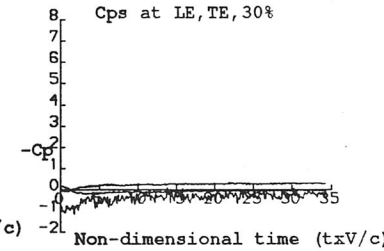
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

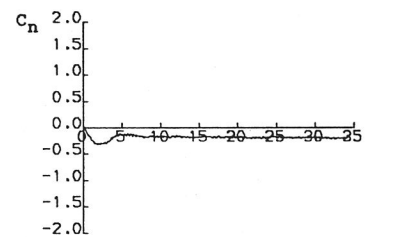
RUN REFERENCE NUMBER: 30411
REYNOLDS NUMBER = 1502106.
DYNAMIC PRESSURE = 1004.23 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

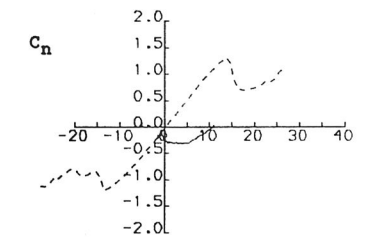
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.0°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03108
LINEAR PITCH RATE = $-264.48°S^{-1}$

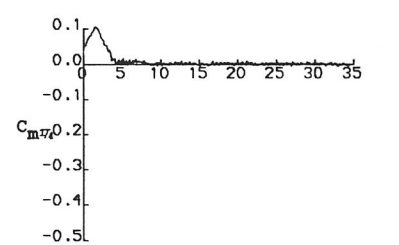


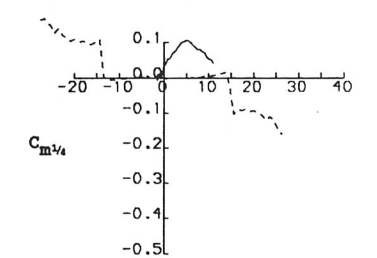


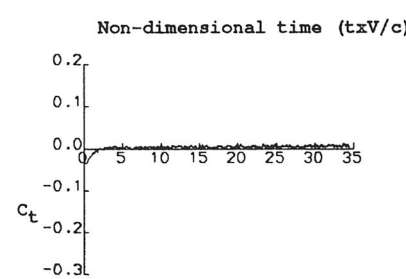


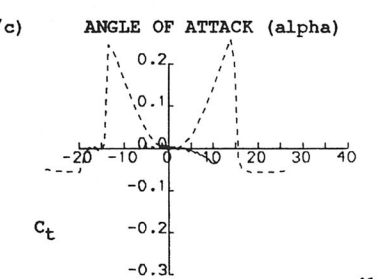








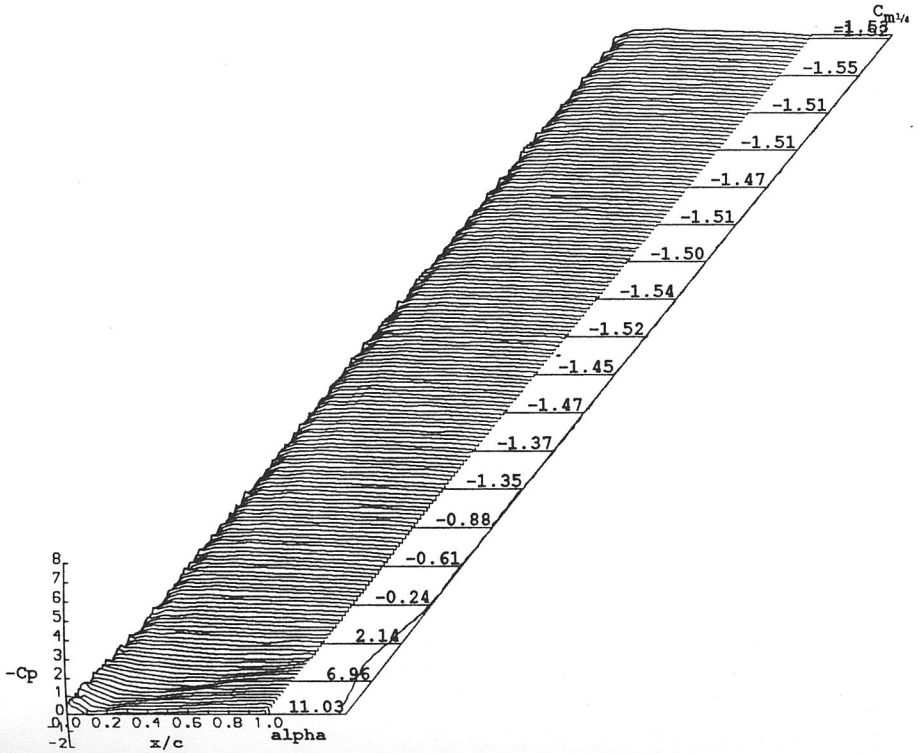


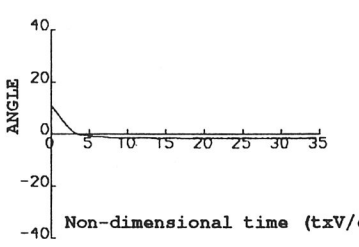


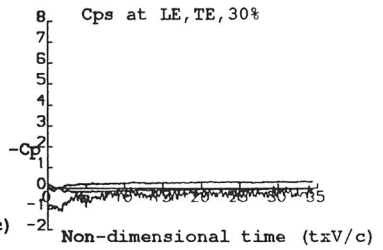
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

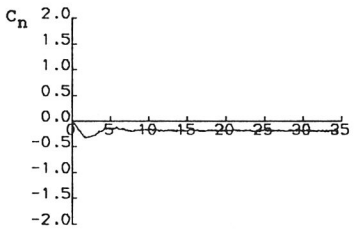
RUN REFERENCE NUMBER: 30421
REYNOLDS NUMBER = 1492441.
DYNAMIC PRESSURE = 1004.23 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

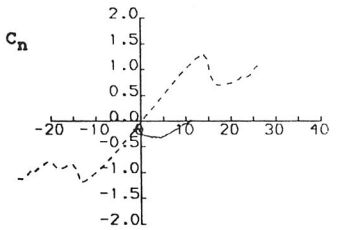
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03264
LINEAR PITCH RATE = -278.41°S^{-1}

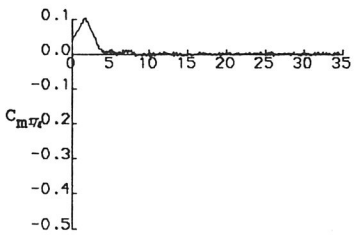


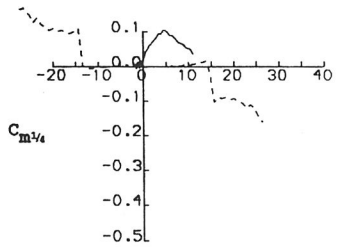


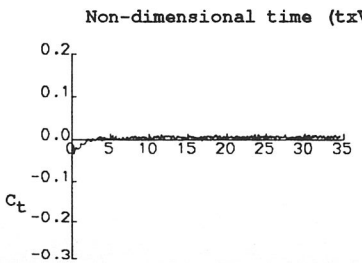


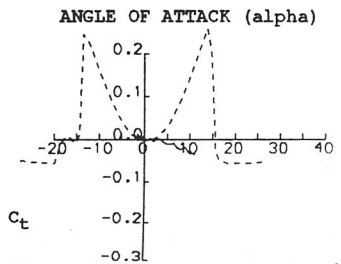








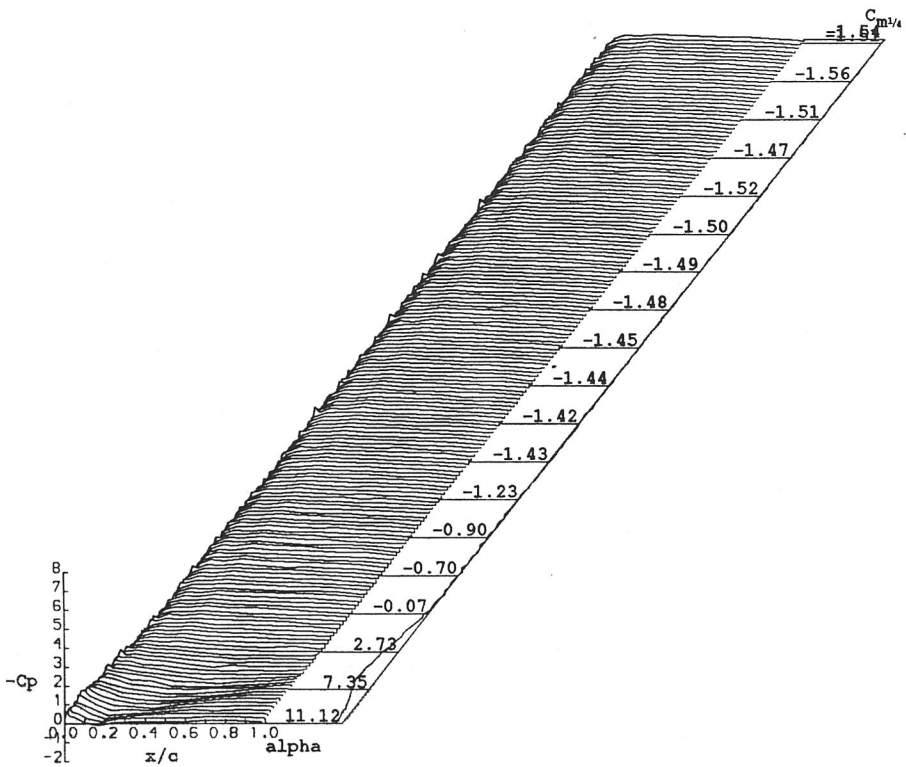


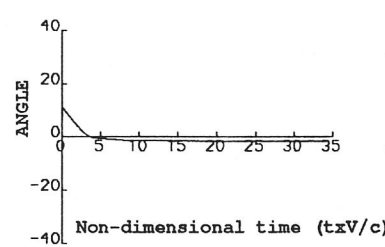


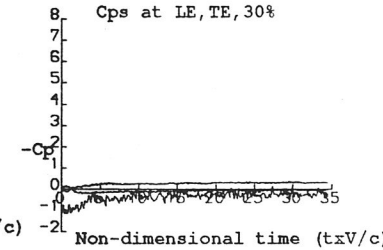
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

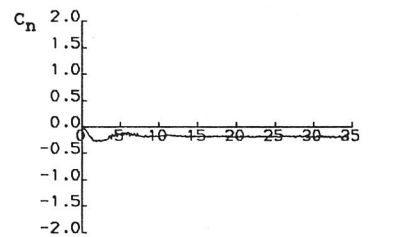
RUN REFERENCE NUMBER: 30431
REYNOLDS NUMBER = 1490522.
DYNAMIC PRESSURE = 1004.23 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

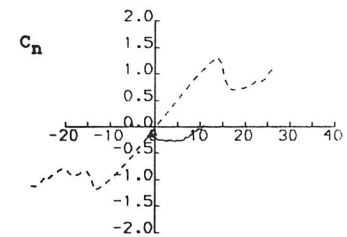
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03005
LINEAR PITCH RATE = -256.49°S^{-1}

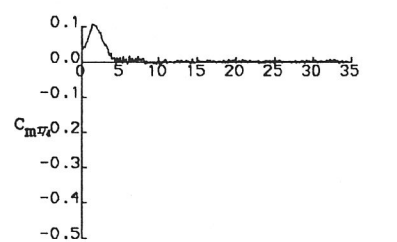


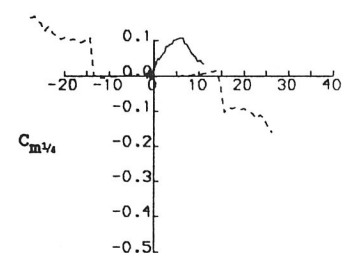


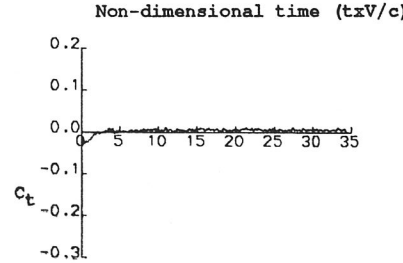


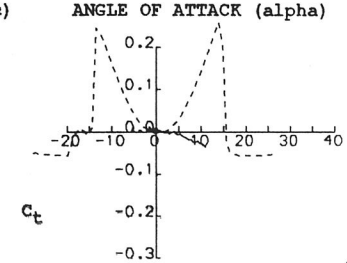








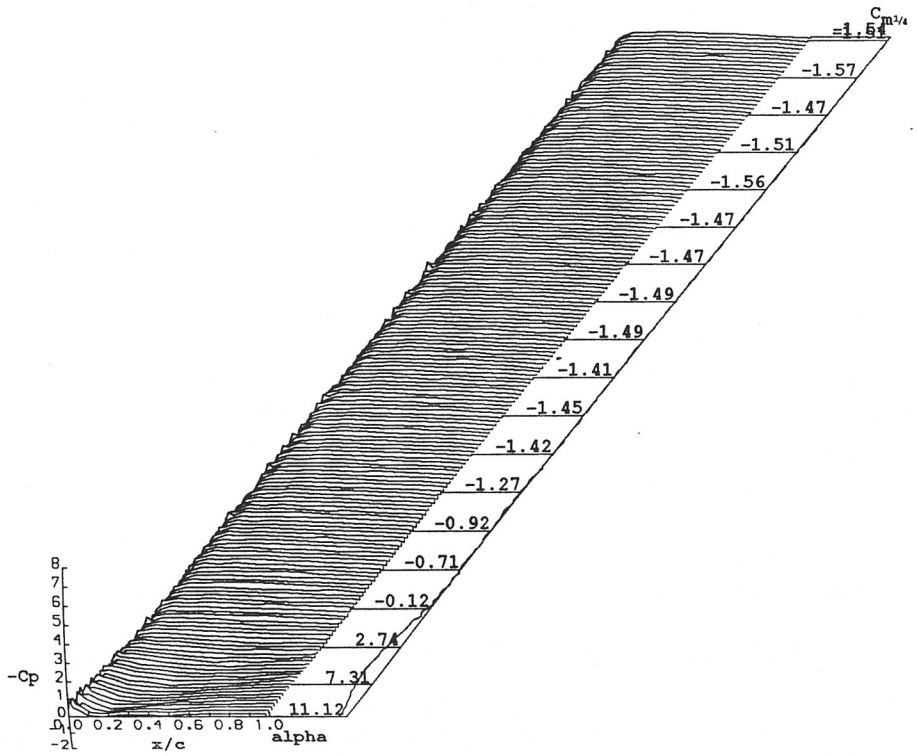


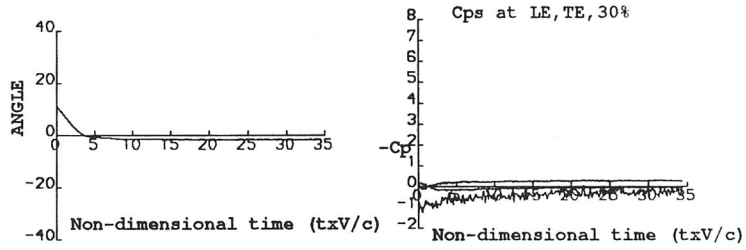


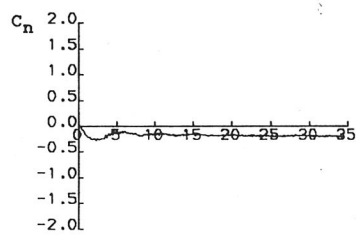
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

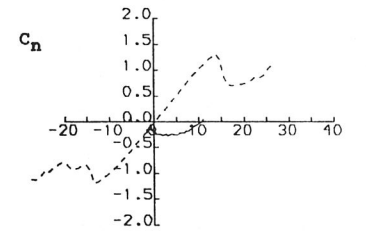
RUN REFERENCE NUMBER: 30441
REYNOLDS NUMBER = 1485086.
DYNAMIC PRESSURE = 997.78 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

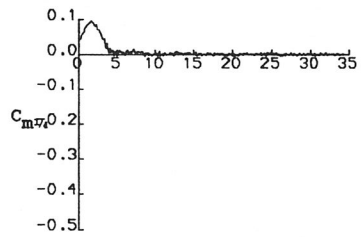
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03043
LINEAR PITCH RATE = $-258.90°s^{-1}$

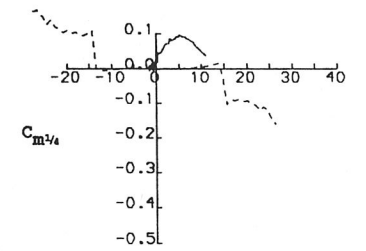


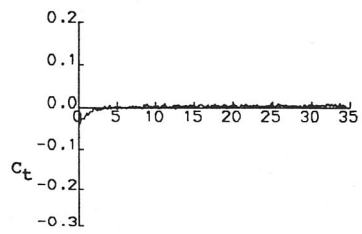


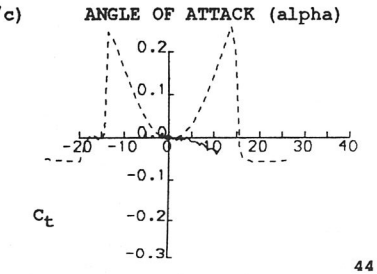








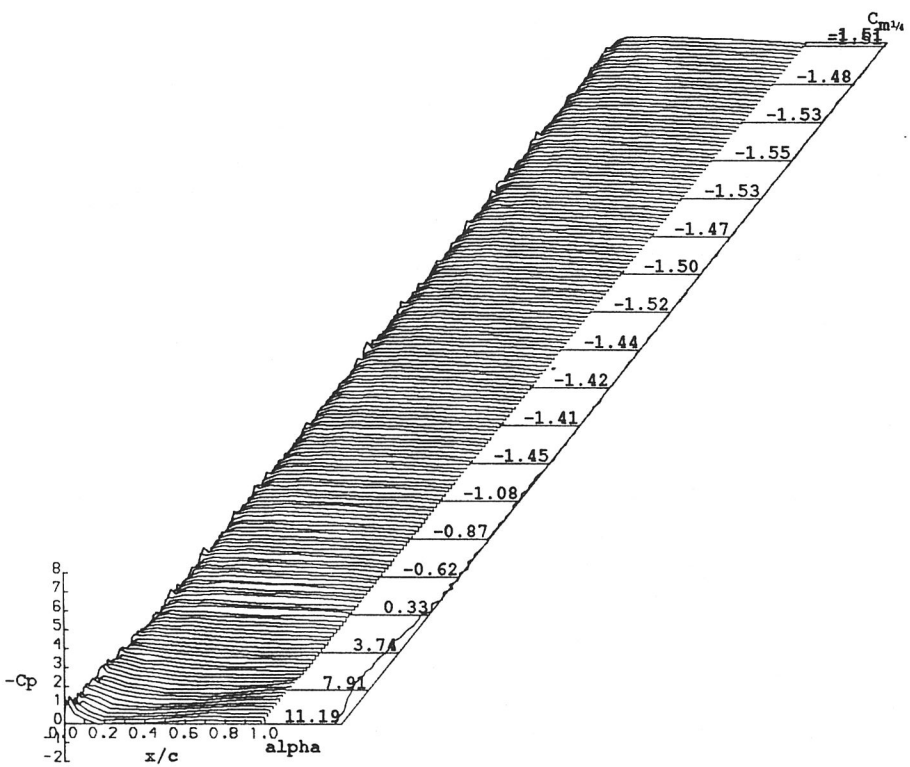


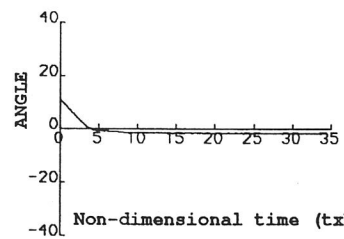


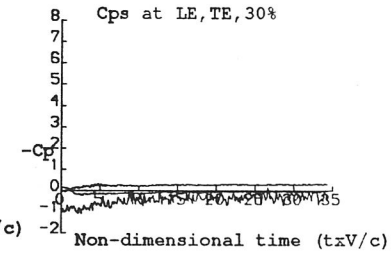
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

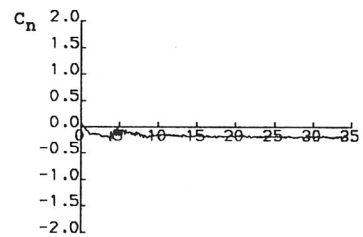
RUN REFERENCE NUMBER: 30451
REYNOLDS NUMBER = 1478749.
DYNAMIC PRESSURE = 997.78 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

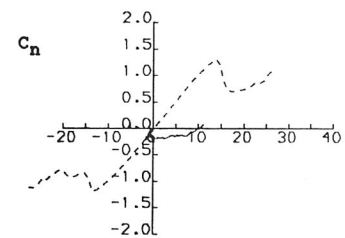
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 26.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02732
LINEAR PITCH RATE = -232.79°S^{-1}

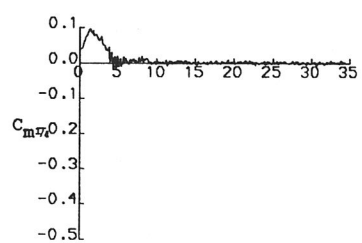


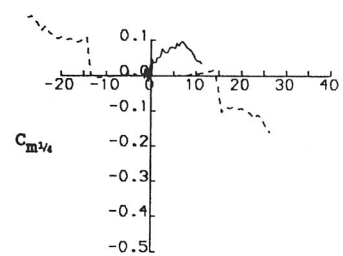


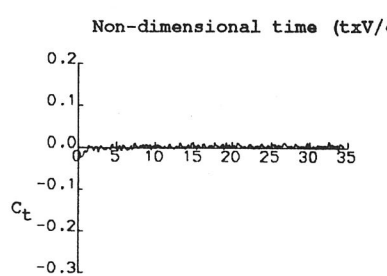


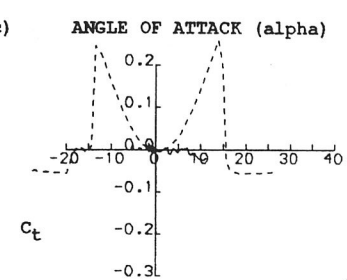






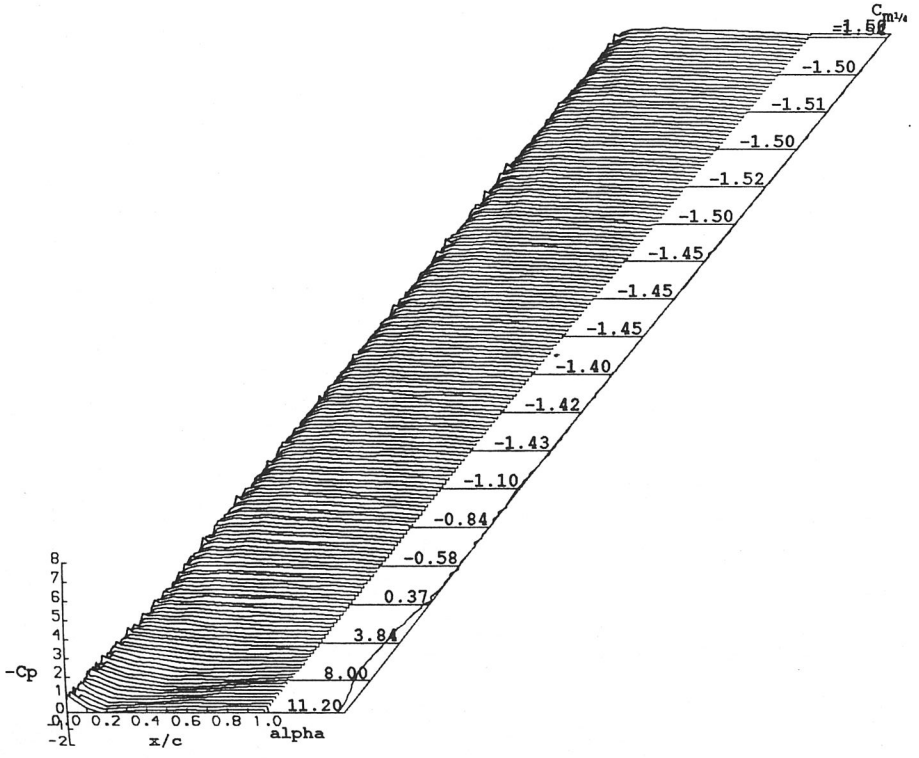


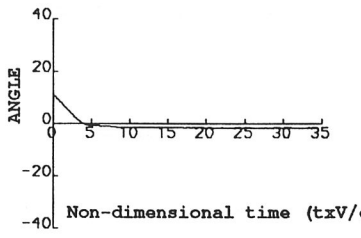


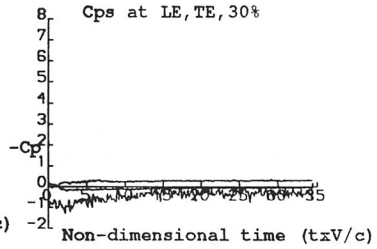


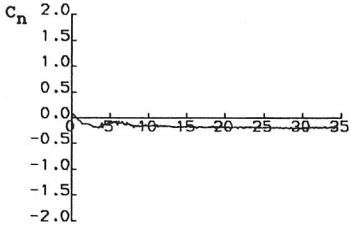
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

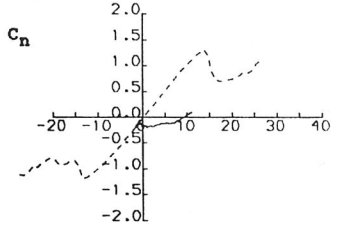
RUN REFERENCE NUMBER: 30461
DATE OF TEST: 17/12/90
REYNOLDS NUMBER = 1476229.
MACH NUMBER = 0.118
DYNAMIC PRESSURE = 997.78 Nm^{-2}
AIR TEMPERATURE = 27.3°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 550.05 Hz.
MOTION TYPE: RAMP DOWN
REDUCED PITCH RATE = -0.02686
START ANGLE = 40.00°
LINEAR PITCH RATE = -229.07°S^{-1}
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

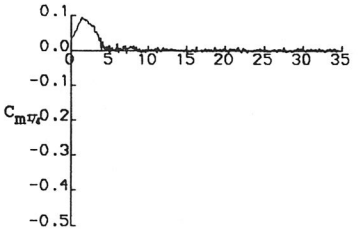


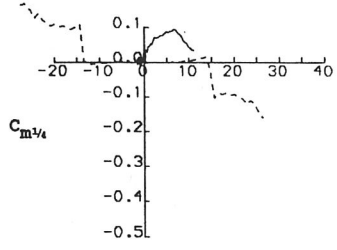






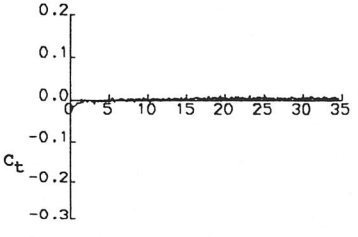


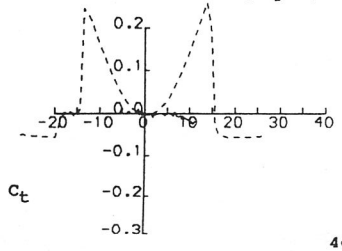




Non-dimensional time (txV/c)

ANGLE OF ATTACK (alpha)

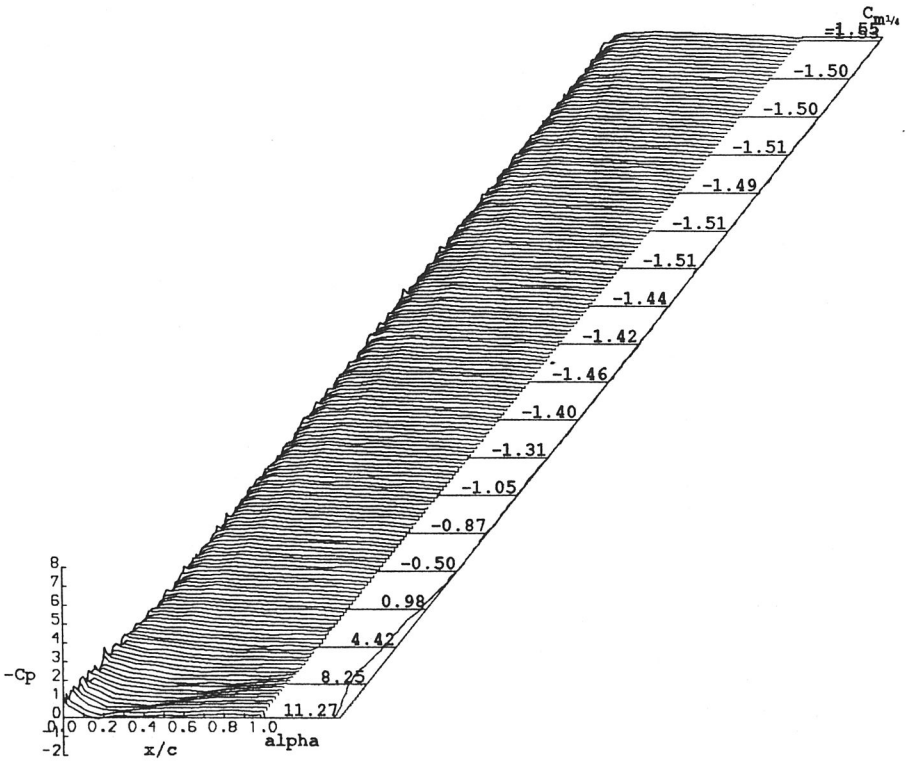


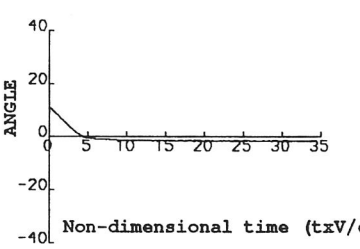


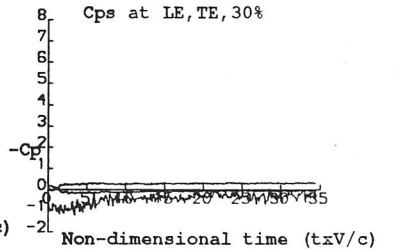
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

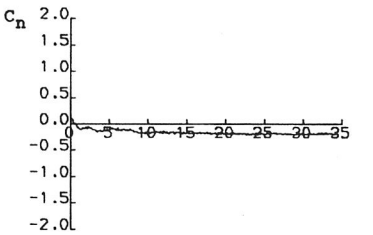
RUN REFERENCE NUMBER: 30471
REYNOLDS NUMBER = 1473090.
DYNAMIC PRESSURE = 997.78 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

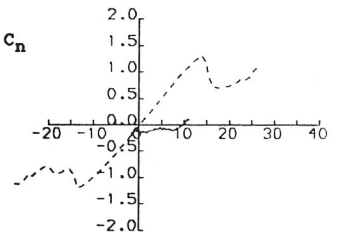
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 27.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02507
LINEAR PITCH RATE = -213.98°S^{-1}

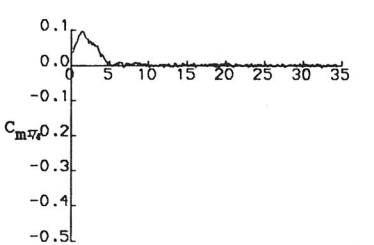


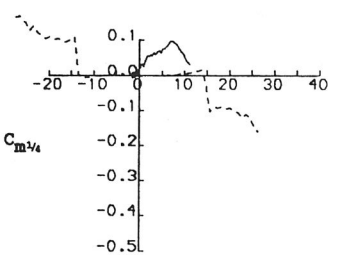


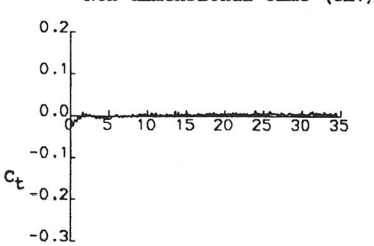


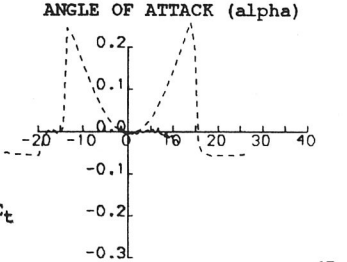






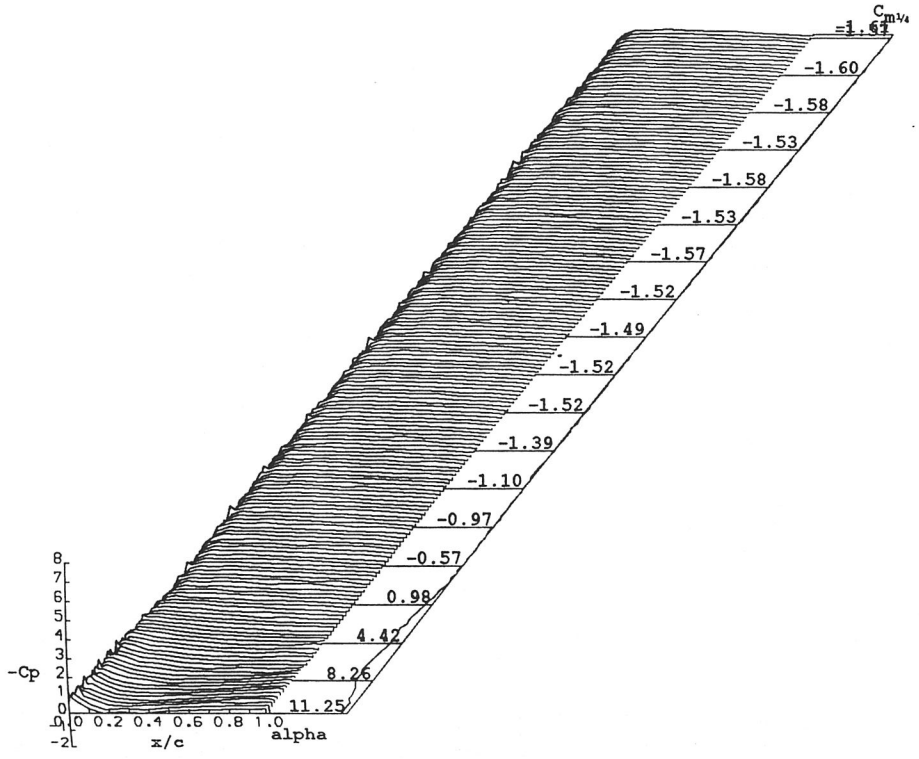


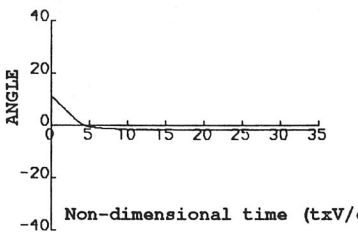


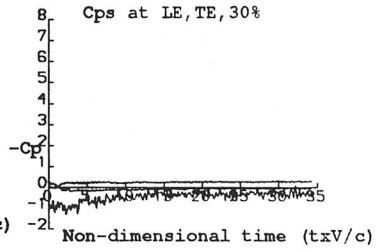


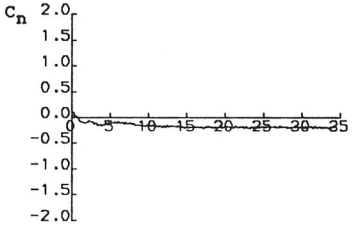
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

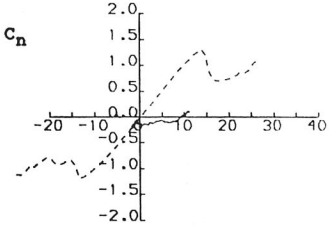
RUN REFERENCE NUMBER: 30481
DATE OF TEST: 17/12/90
REYNOLDS NUMBER = 1470692.
MACH NUMBER = 0.117
DYNAMIC PRESSURE = 988.62 Nm^{-2}
AIR TEMPERATURE = 27.1°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 550.05 Hz.
MOTION TYPE: RAMP DOWN
REDUCED PITCH RATE = -0.02526
START ANGLE = 40.00°
LINEAR PITCH RATE = -214.34°S^{-1}
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

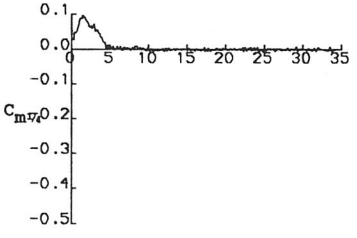


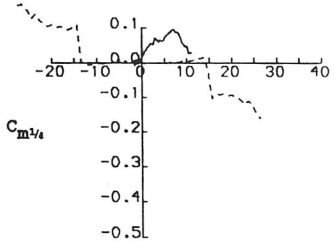


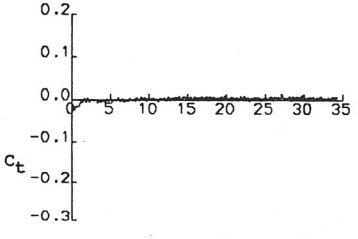


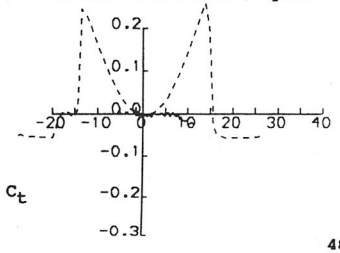








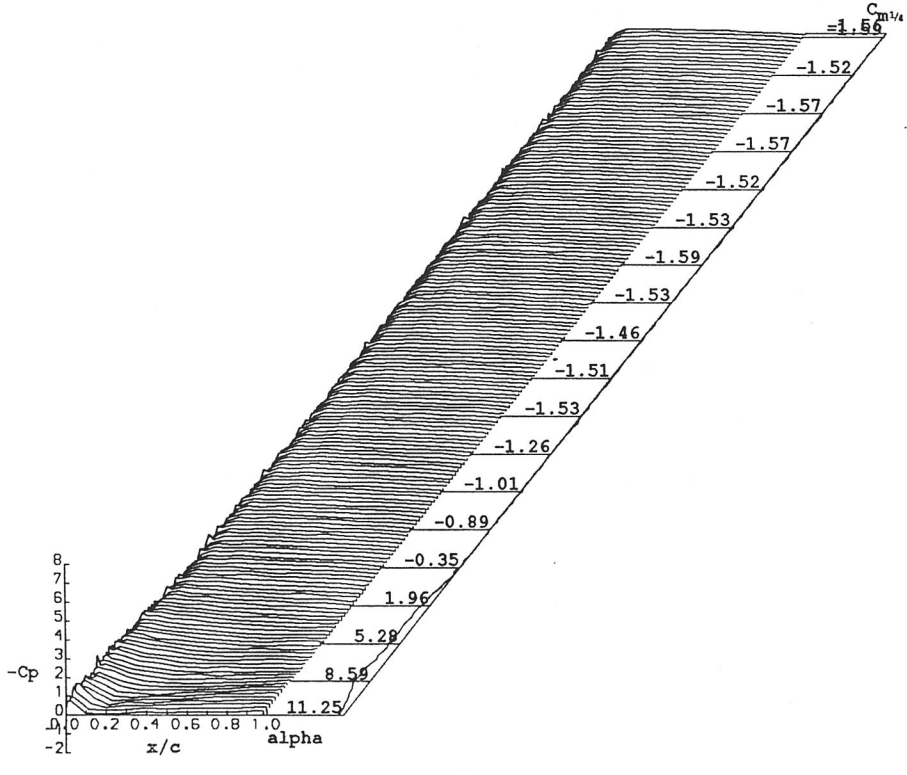


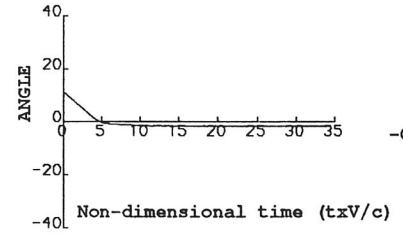


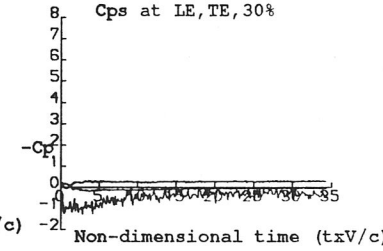
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

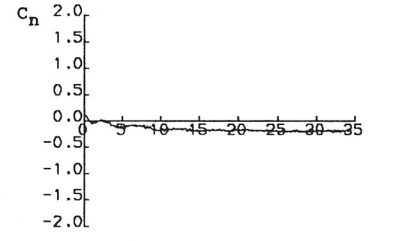
RUN REFERENCE NUMBER: 30491
REYNOLDS NUMBER = 1463202.
DYNAMIC PRESSURE = 988.62 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

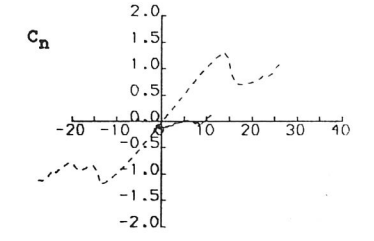
DATE OF TEST: 17/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 28.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02102
LINEAR PITCH RATE = $-178.71°S^{-1}$

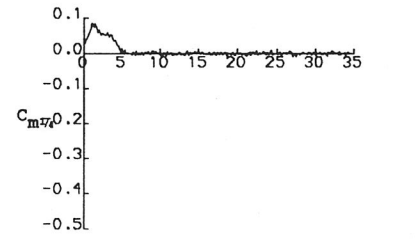


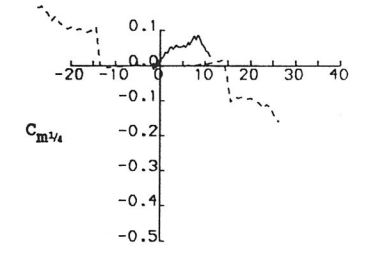


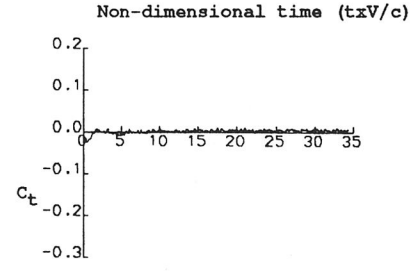


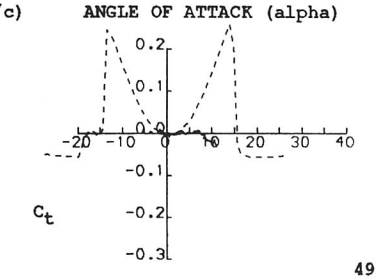








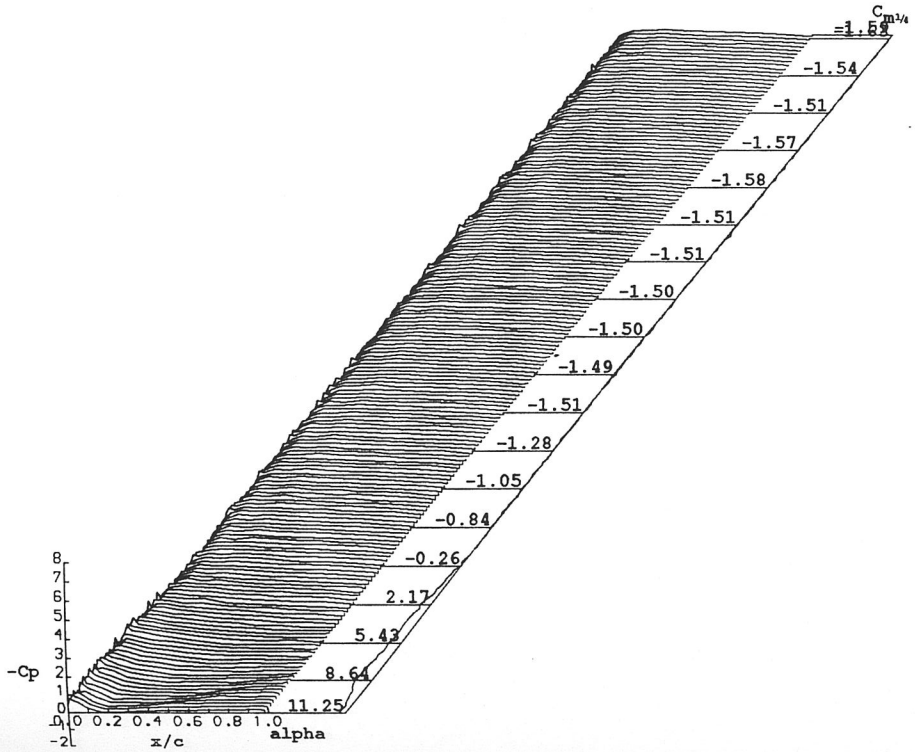


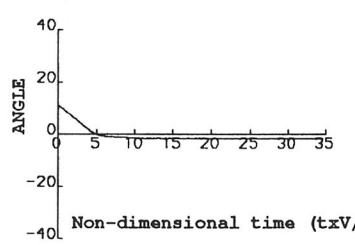


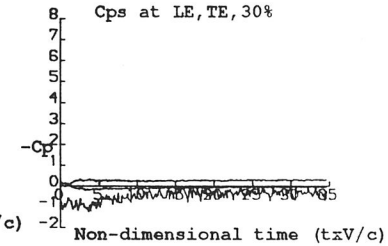
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

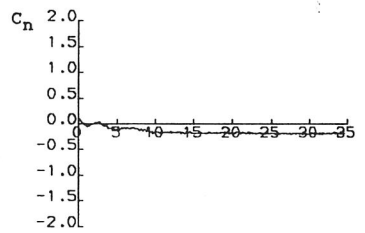
RUN REFERENCE NUMBER: 30501
REYNOLDS NUMBER = 1461961.
DYNAMIC PRESSURE = 988.62 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

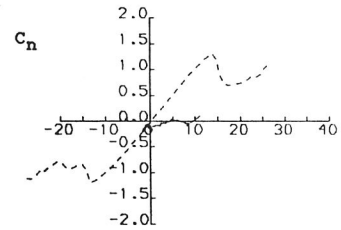
DATE OF TEST: 17/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 28.5°C
SAMPLING FREQUENCY = 544.96 Hz.
REDUCED PITCH RATE = -0.02101
LINEAR PITCH RATE = -178.71°S^{-1}

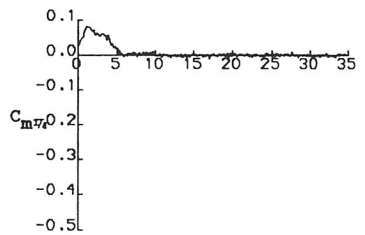


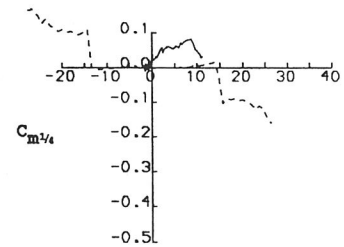


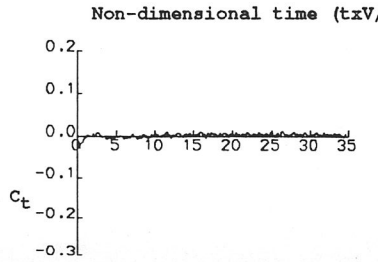


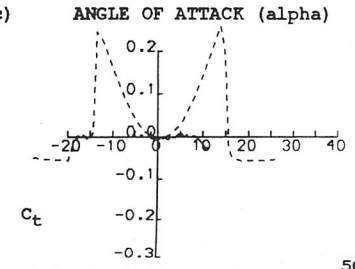








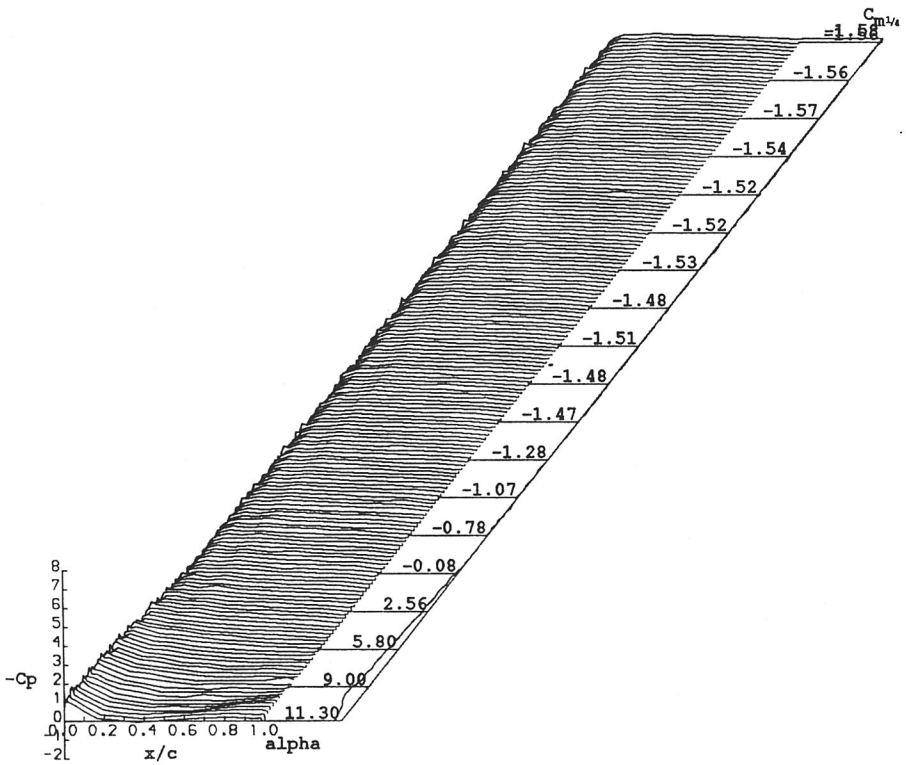


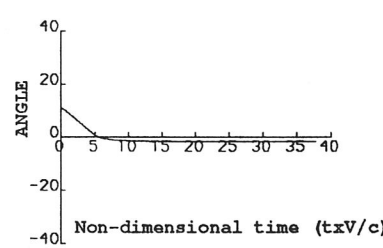


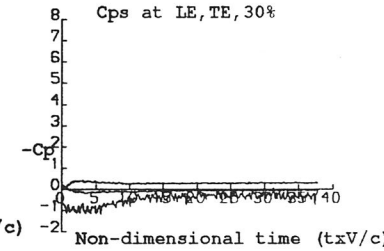
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

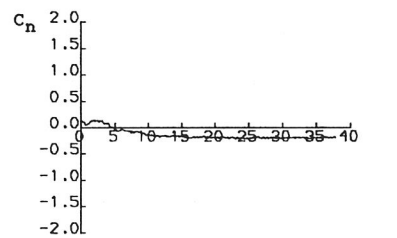
RUN REFERENCE NUMBER: 30511
REYNOLDS NUMBER = 1459485.
DYNAMIC PRESSURE = 988.62 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

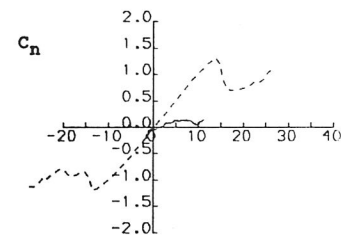
DATE OF TEST: 17/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 28.9°C
SAMPLING FREQUENCY = 500.00 Hz.
REDUCED PITCH RATE = -0.01899
LINEAR PITCH RATE = $-161.67°S^{-1}$

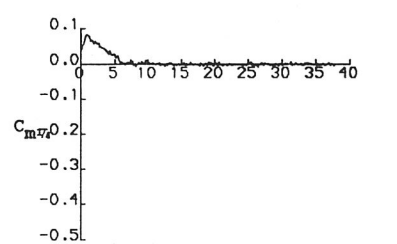


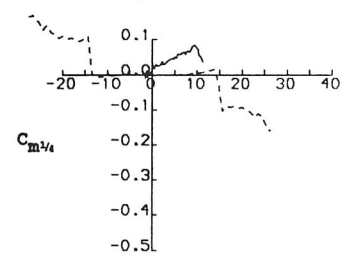


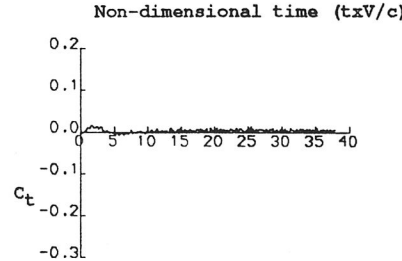


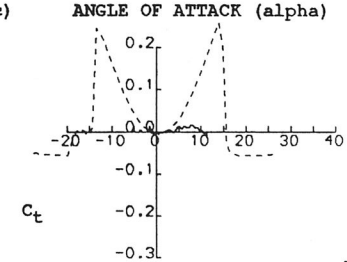








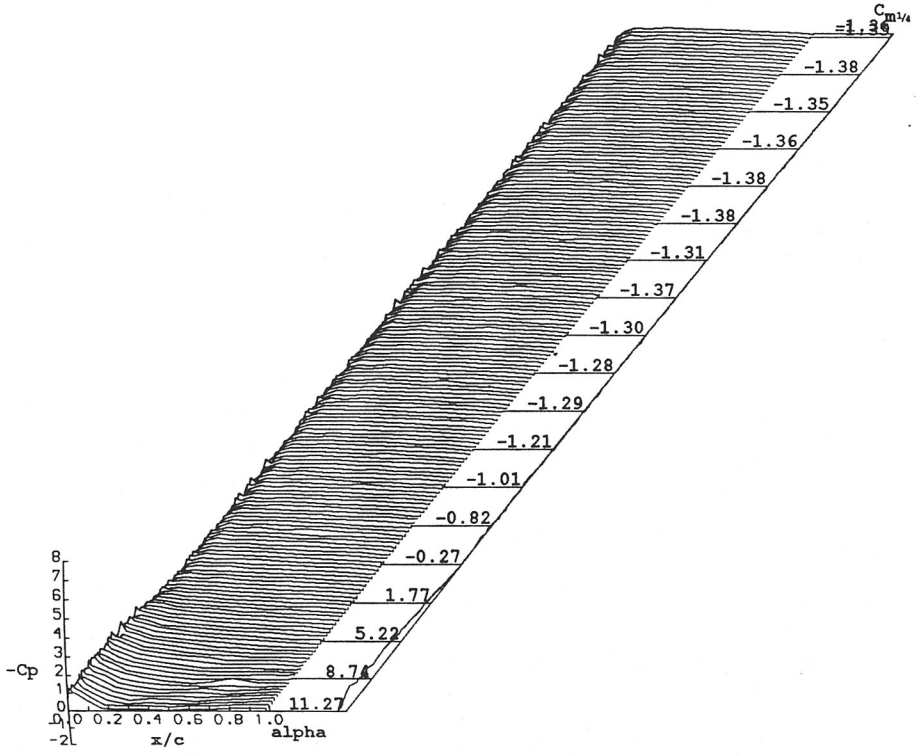


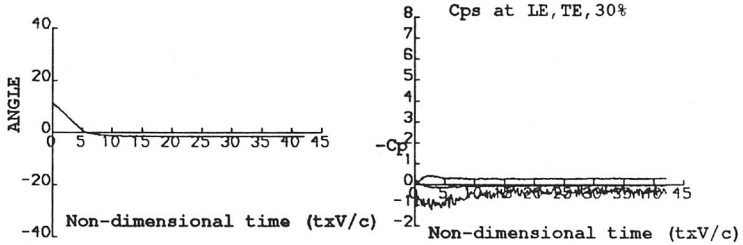


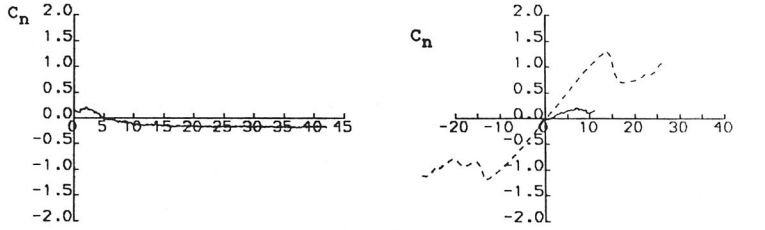
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

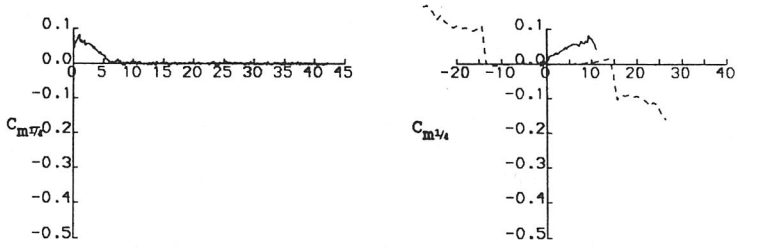
RUN REFERENCE NUMBER: 30521
REYNOLDS NUMBER = 1466112.
DYNAMIC PRESSURE = 994.24 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

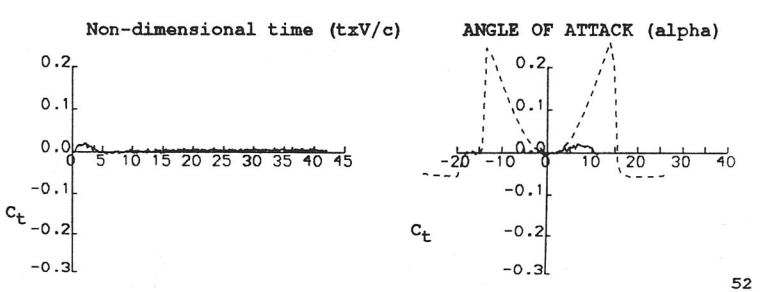
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 28.5°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = -0.01794
LINEAR PITCH RATE = $-153.04°S^{-1}$







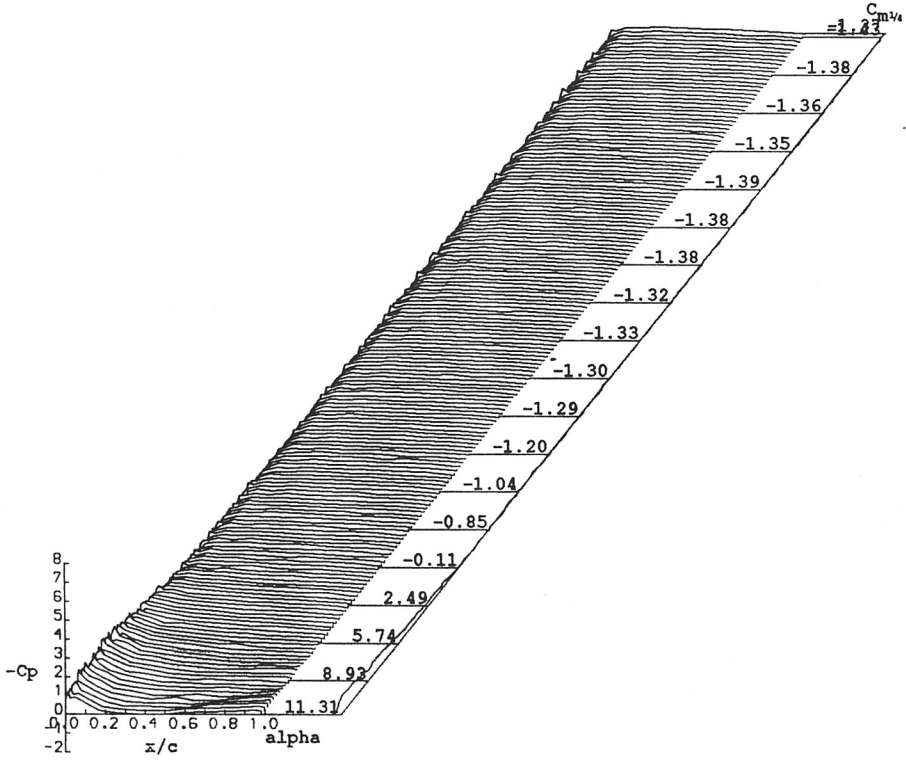


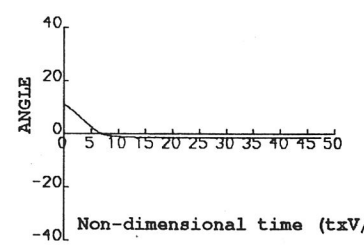


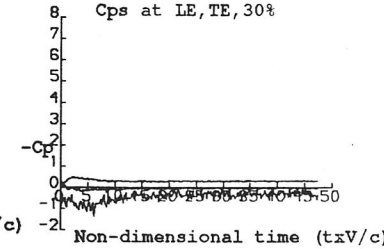
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

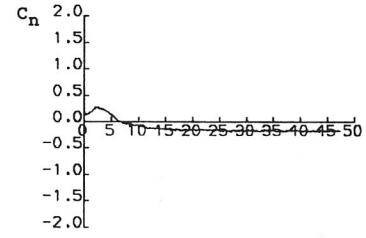
RUN REFERENCE NUMBER: 30531
REYNOLDS NUMBER = 1461153.
DYNAMIC PRESSURE = 994.24 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

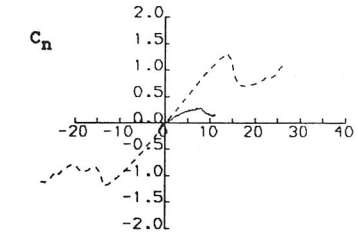
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 29.3°C
SAMPLING FREQUENCY = 400.00 Hz.
REDUCED PITCH RATE = -0.01600
LINEAR PITCH RATE = -136.62°S^{-1}

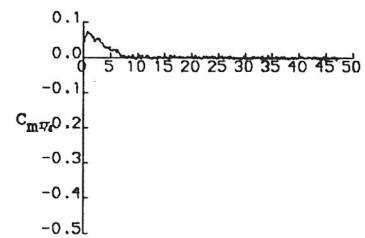


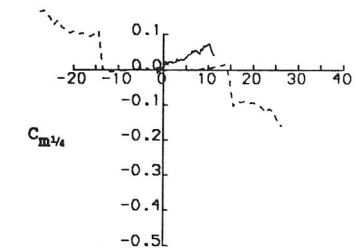


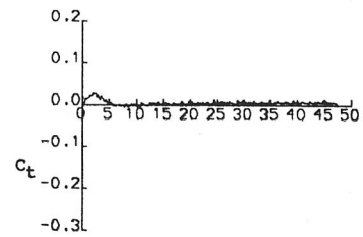


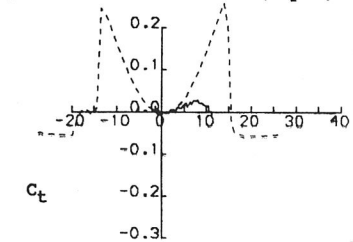








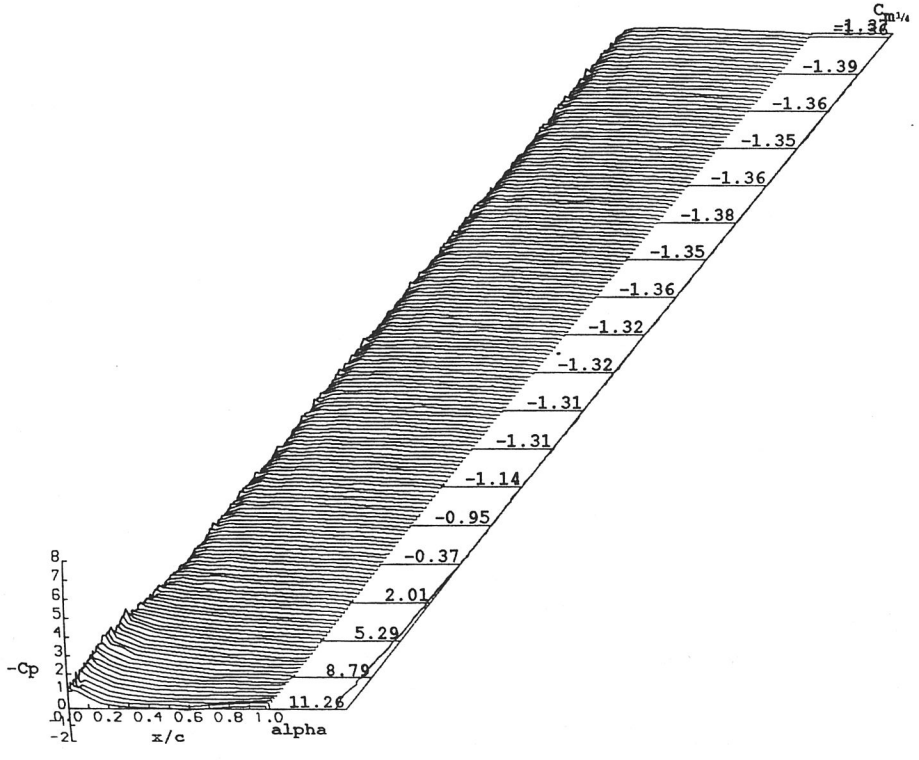


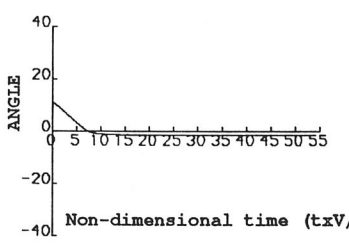


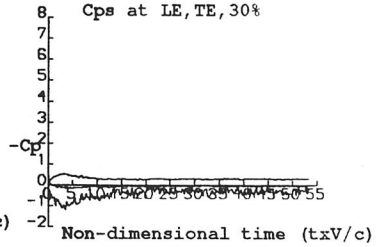
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

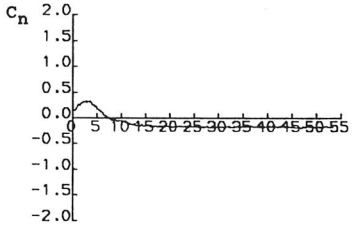
RUN REFERENCE NUMBER: 30541
REYNOLDS NUMBER = 1459301.
DYNAMIC PRESSURE = 994.24 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

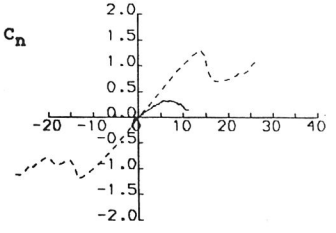
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 29.6°C
SAMPLING FREQUENCY = 354.99 Hz.
REDUCED PITCH RATE = -0.01472
LINEAR PITCH RATE = $-125.75°S^{-1}$

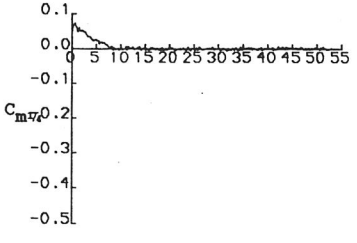


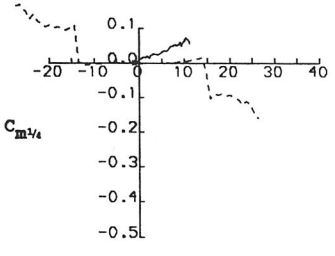


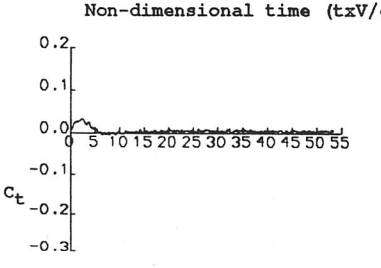


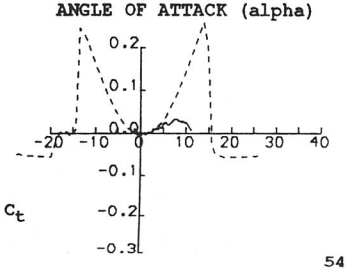








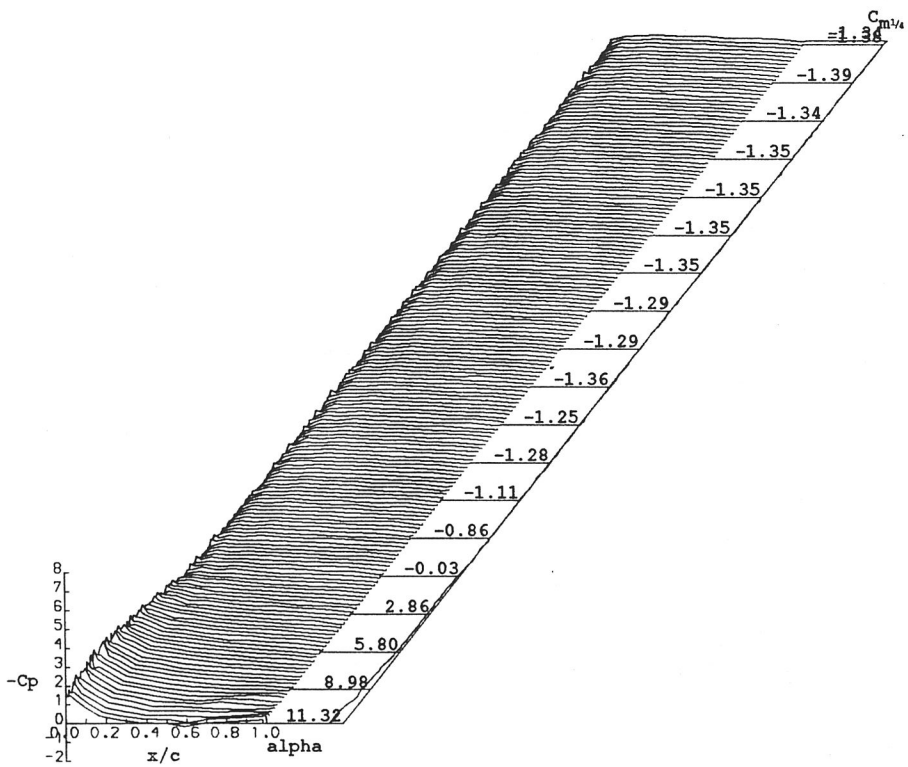


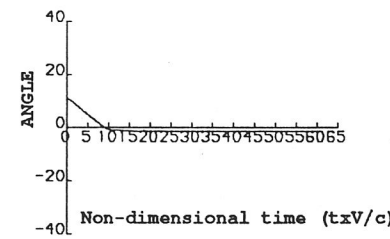


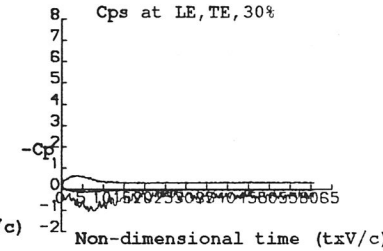
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

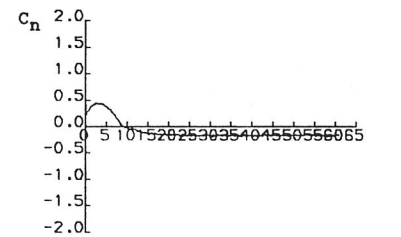
RUN REFERENCE NUMBER: 30551
REYNOLDS NUMBER = 1457455.
DYNAMIC PRESSURE = 994.24 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

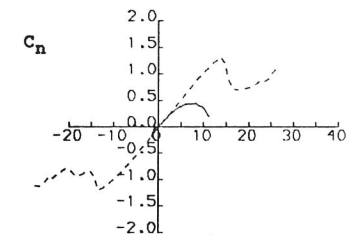
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 29.9°C
SAMPLING FREQUENCY = 312.01 Hz.
REDUCED PITCH RATE = -0.01176
LINEAR PITCH RATE = $-100.52°S^{-1}$

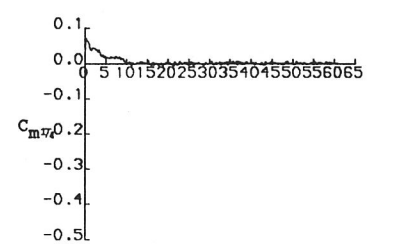


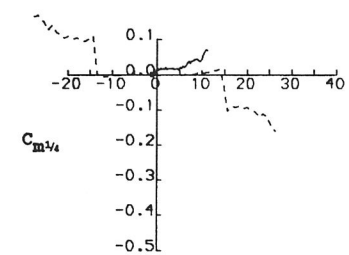


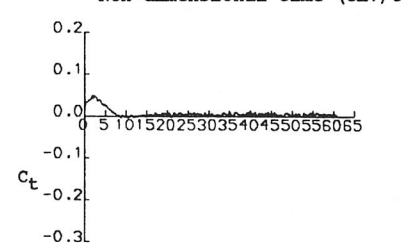


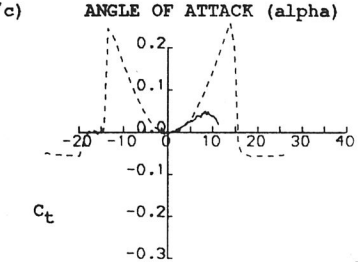








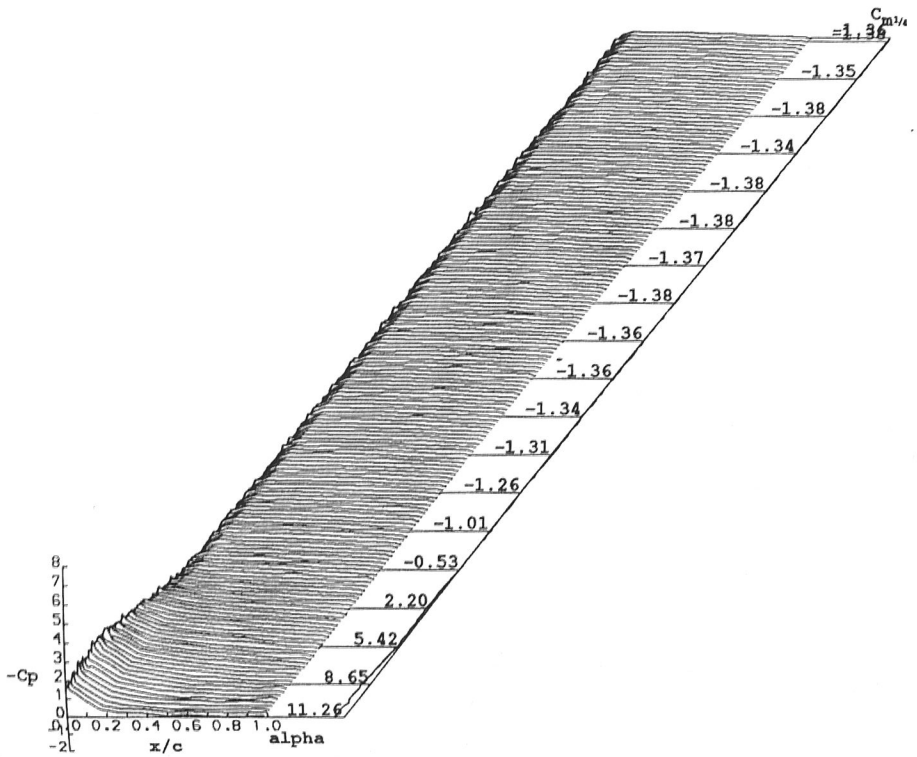


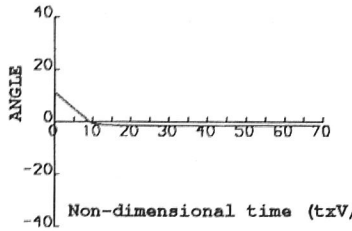


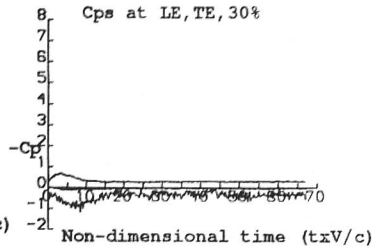
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

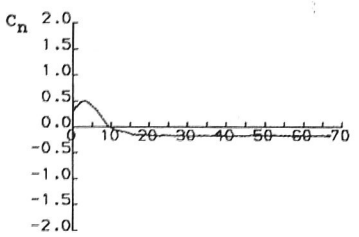
RUN REFERENCE NUMBER: 30561
REYNOLDS NUMBER = 1475376.
DYNAMIC PRESSURE = 984.77 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

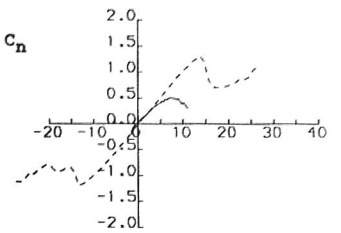
DATE OF TEST: 17/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 25.9°C
SAMPLING FREQUENCY = 280.03 Hz.
REDUCED PITCH RATE = -0.01056
LINEAR PITCH RATE = $-89.27°S^{-1}$

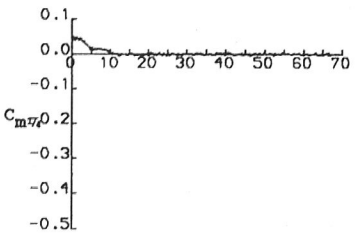


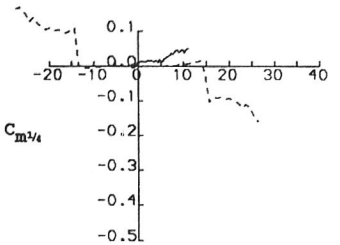


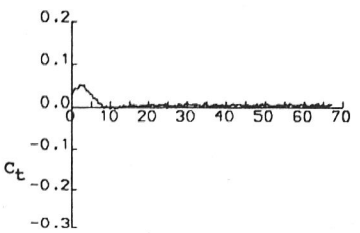


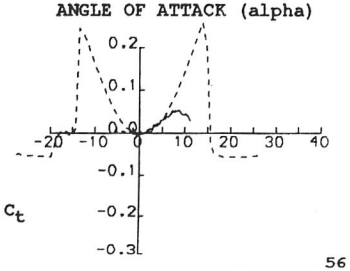








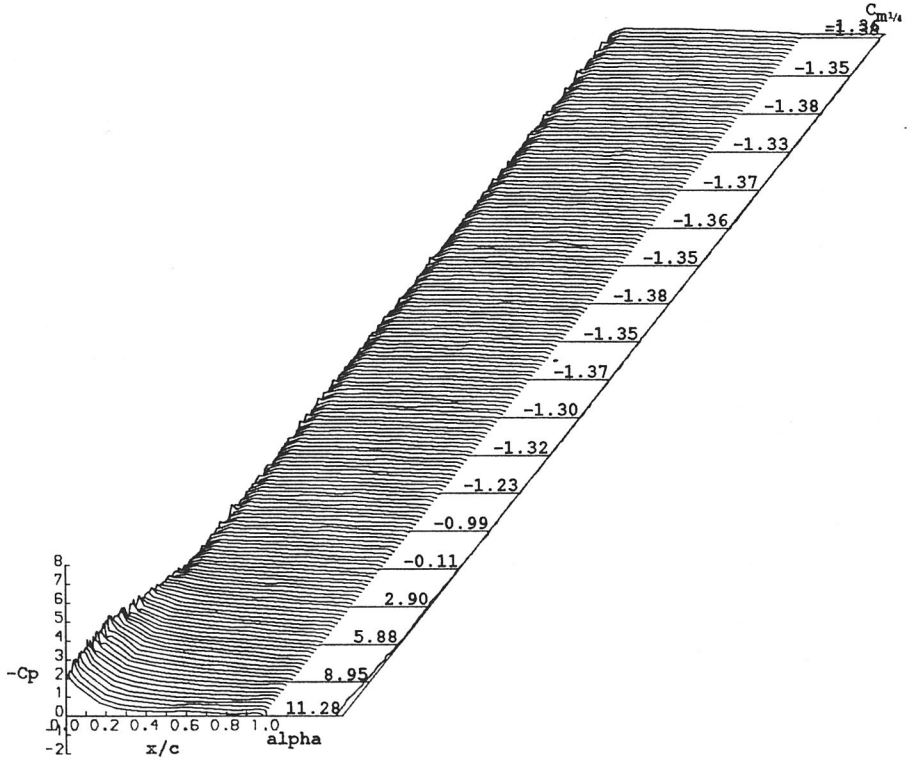


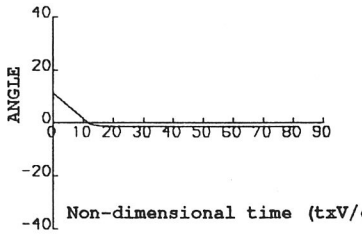


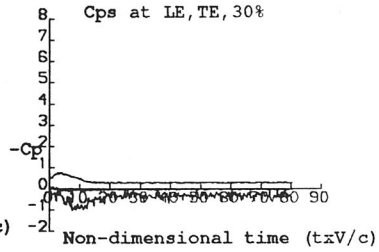
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

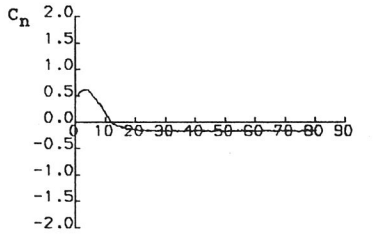
RUN REFERENCE NUMBER: 30571
REYNOLDS NUMBER = 1466577.
DYNAMIC PRESSURE = 984.77 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

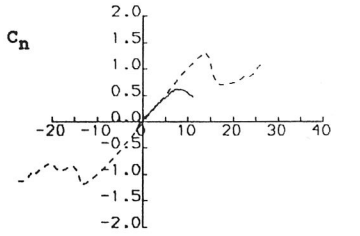
DATE OF TEST: 17/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 27.3°C
SAMPLING FREQUENCY = 233.97 Hz.
REDUCED PITCH RATE = -0.00838
LINEAR PITCH RATE = $-71.04°S^{-1}$

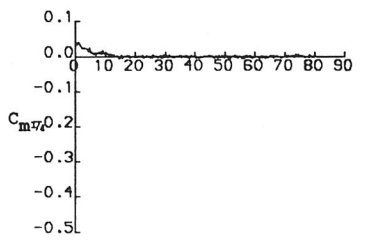


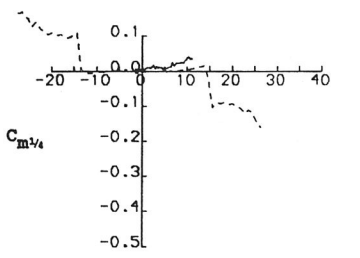


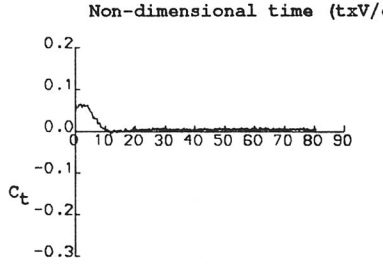


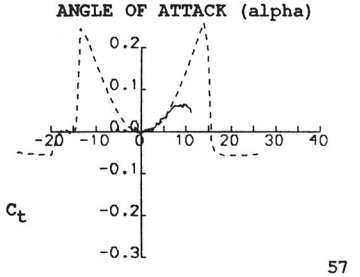








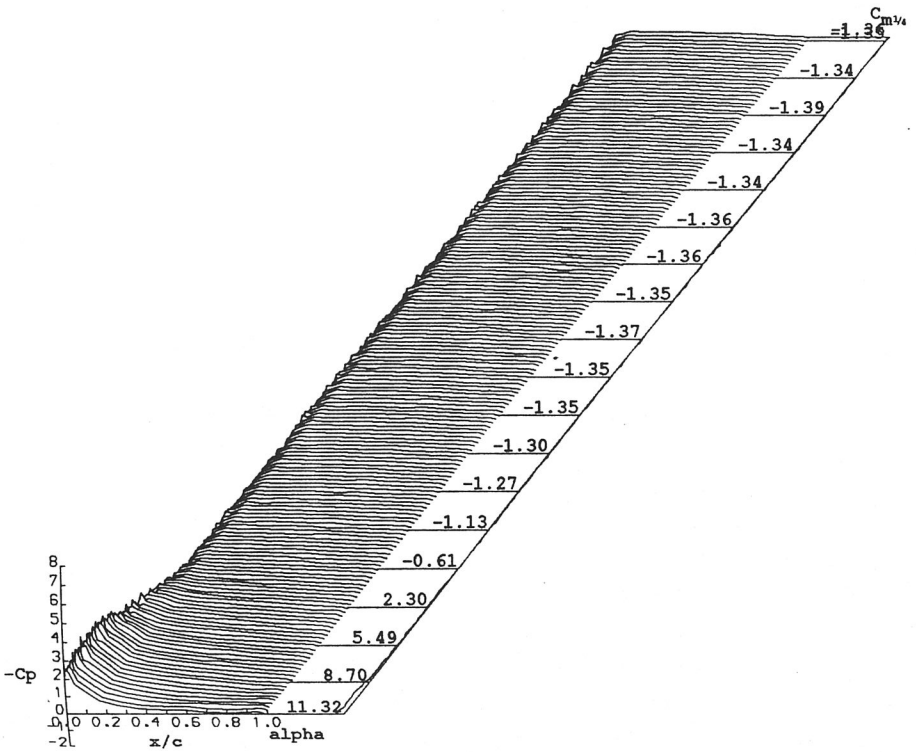


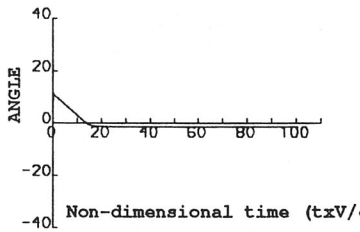


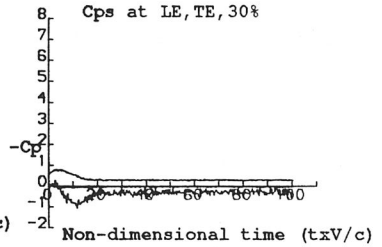
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

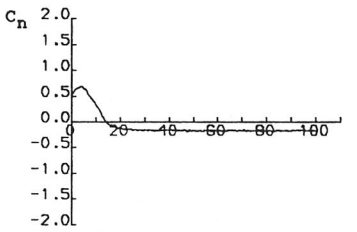
RUN REFERENCE NUMBER: 30581
REYNOLDS NUMBER = 1462837.
DYNAMIC PRESSURE = 984.77 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

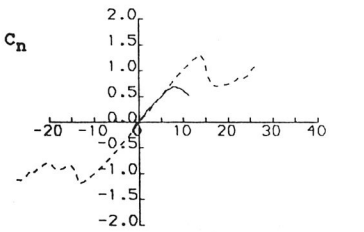
DATE OF TEST: 17/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 27.9°C
SAMPLING FREQUENCY = 186.99 Hz.
REDUCED PITCH RATE = -0.00720
LINEAR PITCH RATE = $-61.03°S^{-1}$

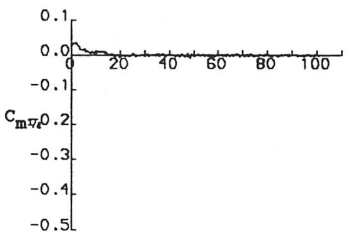


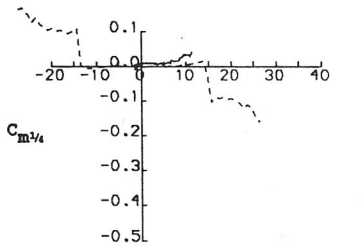


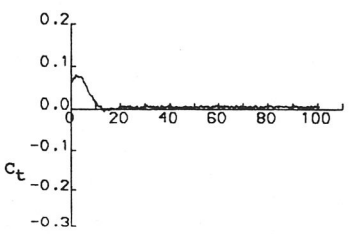


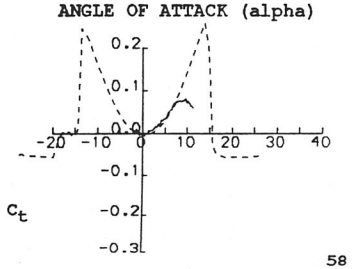






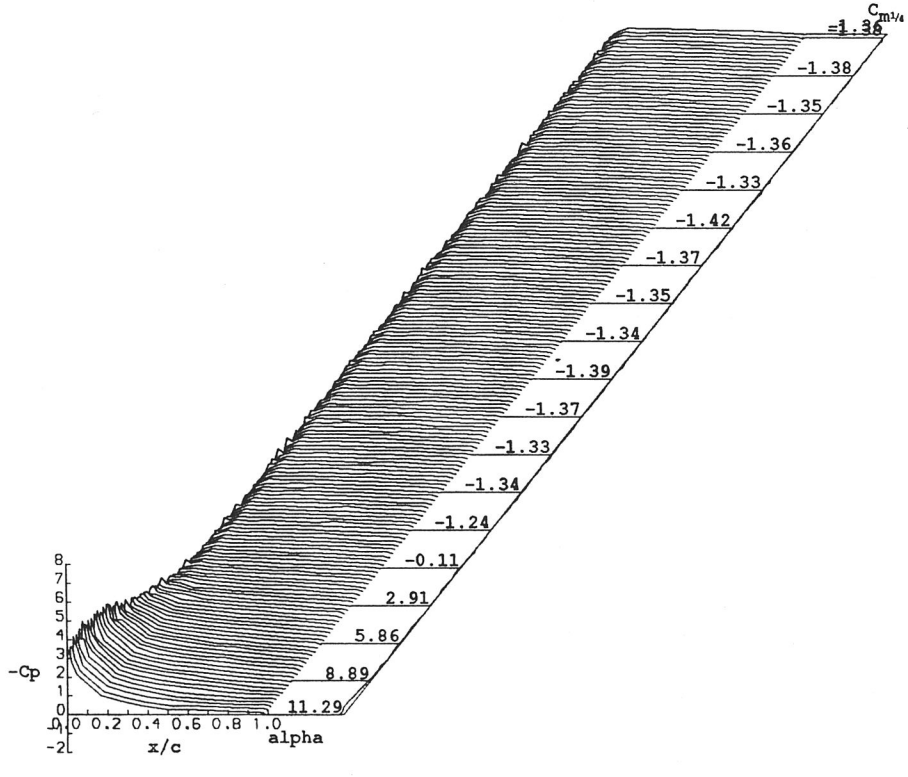


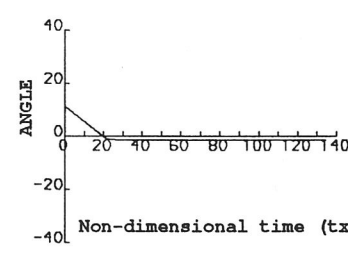


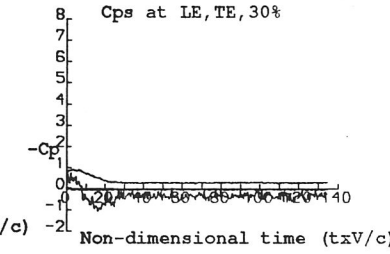


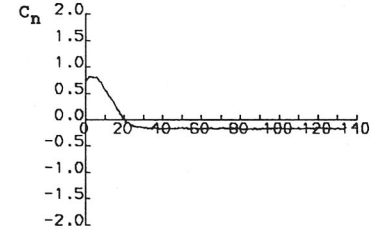
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

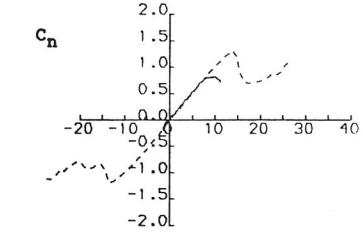
RUN REFERENCE NUMBER: 30591
DATE OF TEST: 17/12/90
REYNOLDS NUMBER = 1459734.
MACH NUMBER = 0.117
DYNAMIC PRESSURE = 984.77 Nm^{-2}
AIR TEMPERATURE = 28.4°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 140.00 Hz.
MOTION TYPE: RAMP DOWN
REDUCED PITCH RATE = -0.00512
START ANGLE = 40.00°
LINEAR PITCH RATE = -43.47°S^{-1}
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

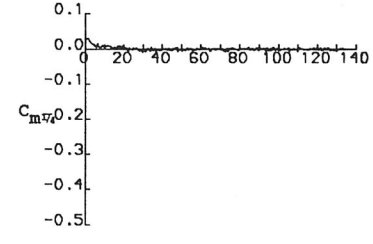


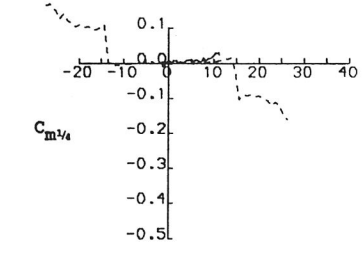


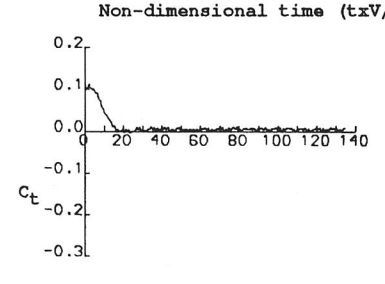


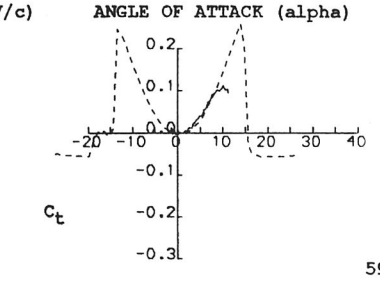








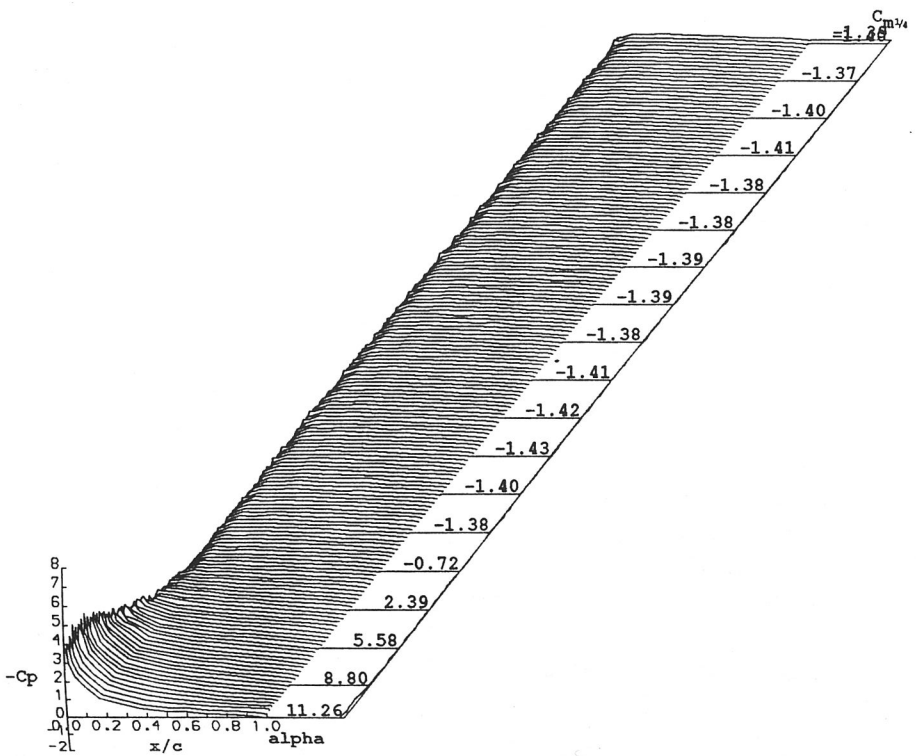


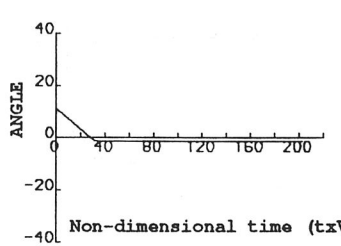


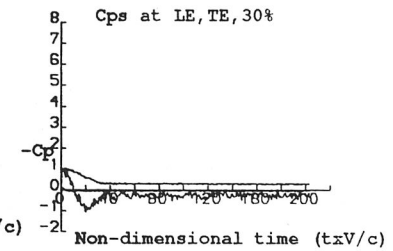
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

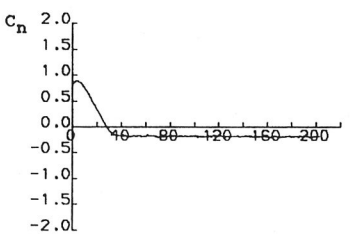
RUN REFERENCE NUMBER: 30601
REYNOLDS NUMBER = 1476457.
DYNAMIC PRESSURE = 1004.05 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

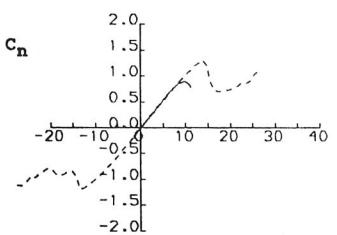
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 28.0°C
SAMPLING FREQUENCY = 93.70 Hz.
REDUCED PITCH RATE = -0.00360
LINEAR PITCH RATE = $-30.82°S^{-1}$

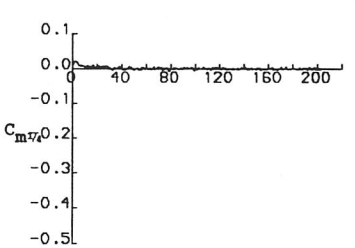


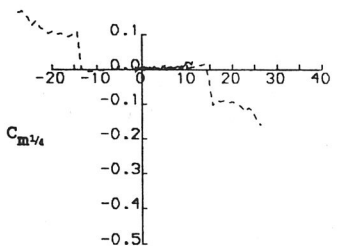


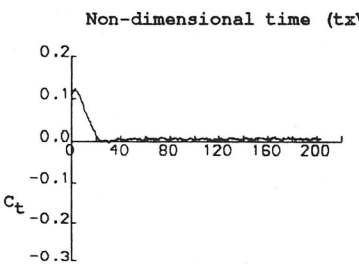


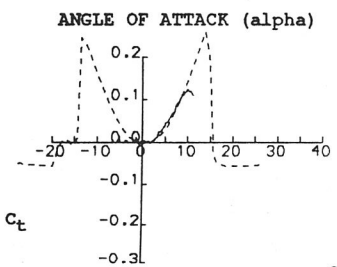








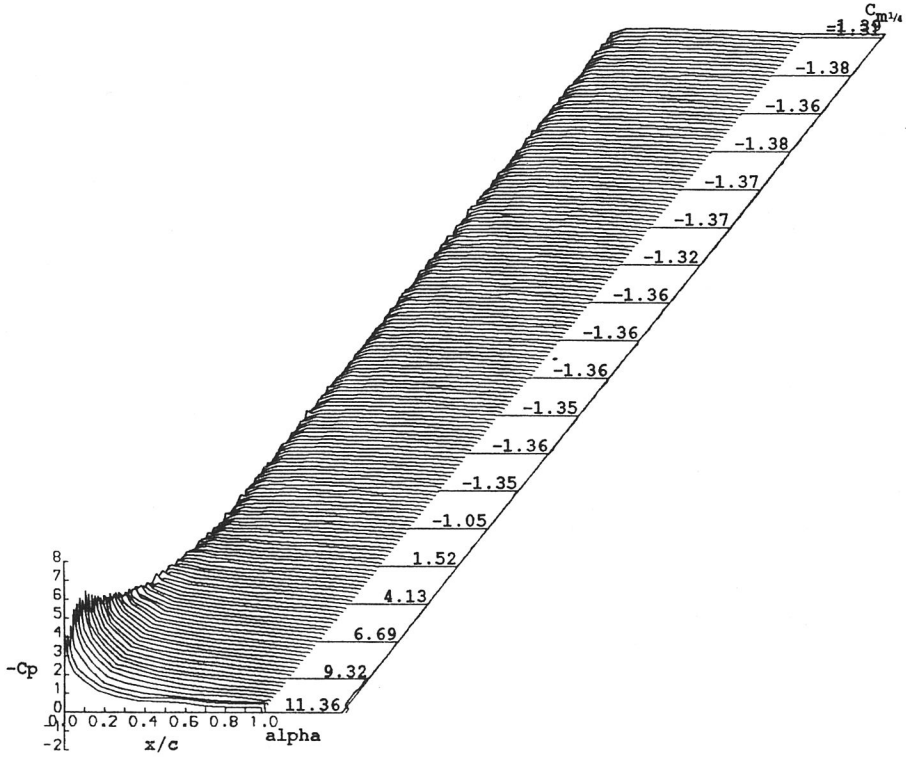


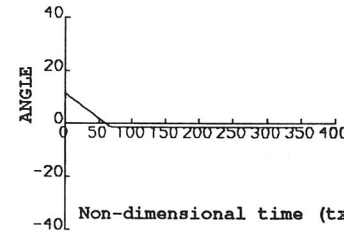


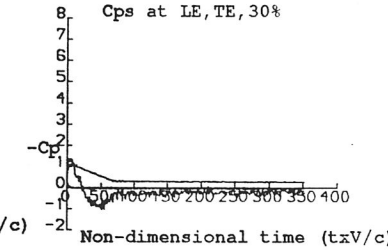
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

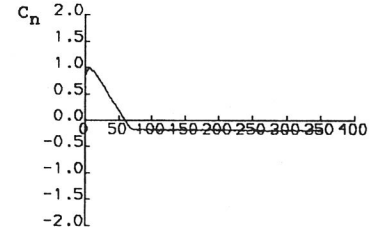
RUN REFERENCE NUMBER: 30611
REYNOLDS NUMBER = 1471454.
DYNAMIC PRESSURE = 1004.05 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

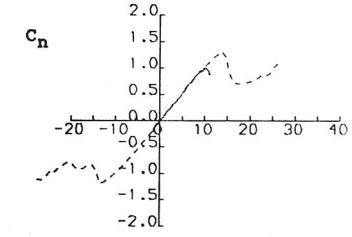
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 28.8°C
SAMPLING FREQUENCY = 54.10 Hz.
REDUCED PITCH RATE = -0.00168
LINEAR PITCH RATE = $-14.37°S^{-1}$

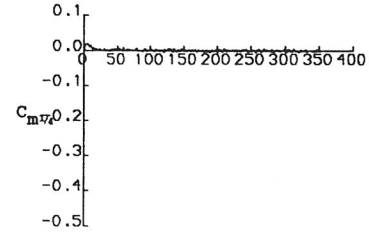


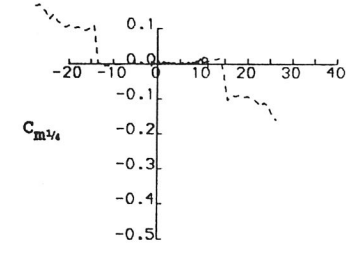


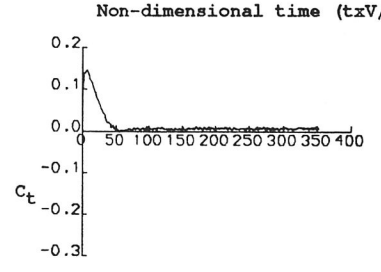


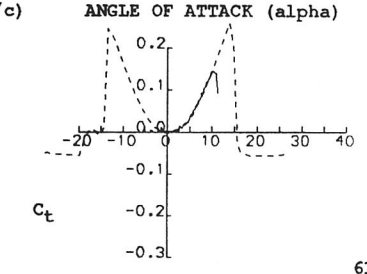








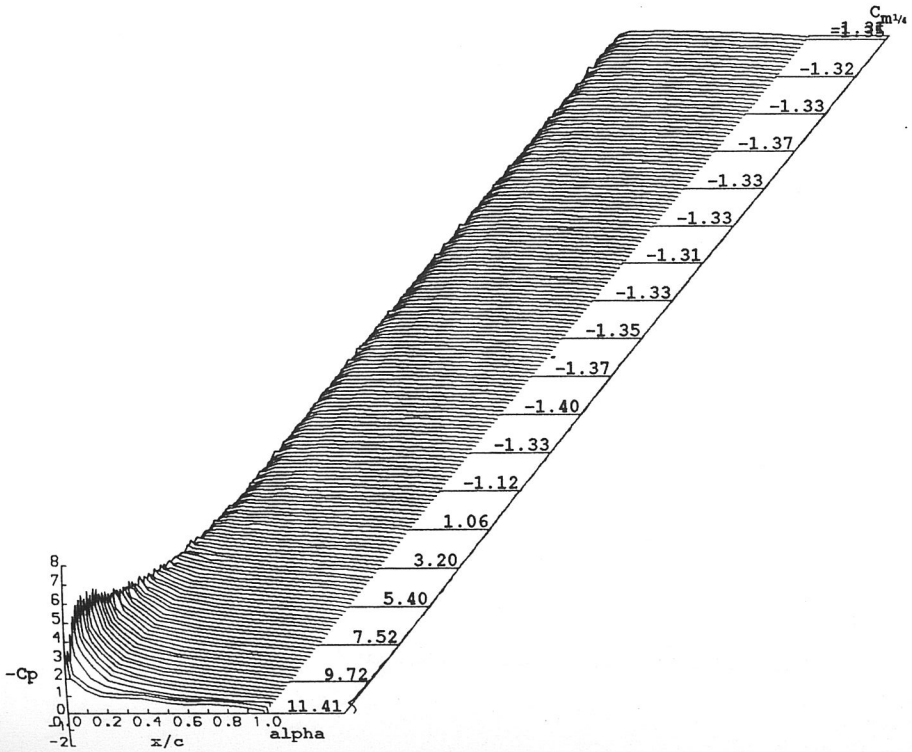


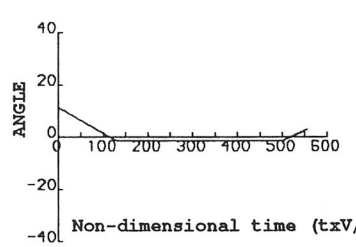


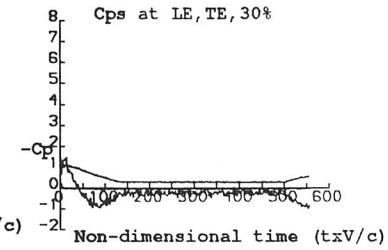
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

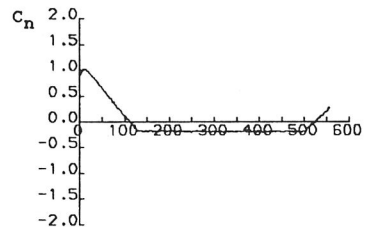
RUN REFERENCE NUMBER: 30621
REYNOLDS NUMBER = 1468964.
DYNAMIC PRESSURE = 1004.05 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

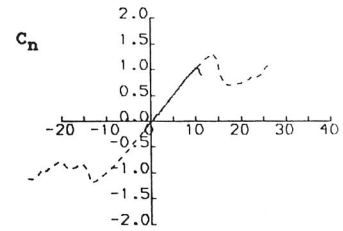
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 29.2°C
SAMPLING FREQUENCY = 34.30 Hz.
REDUCED PITCH RATE = -0.00086
LINEAR PITCH RATE = $-7.39°S^{-1}$

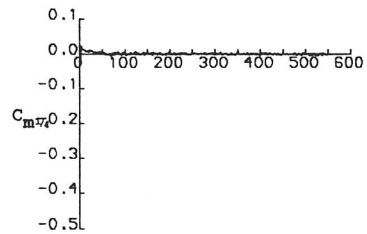


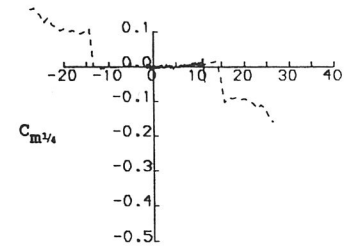


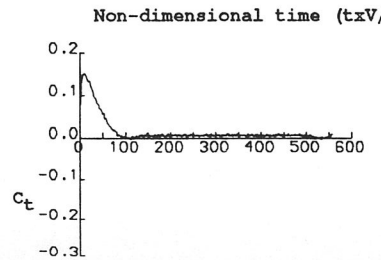


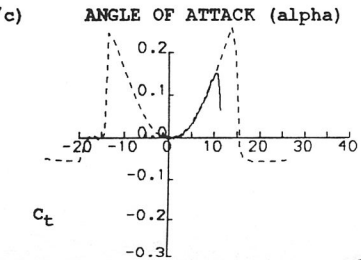






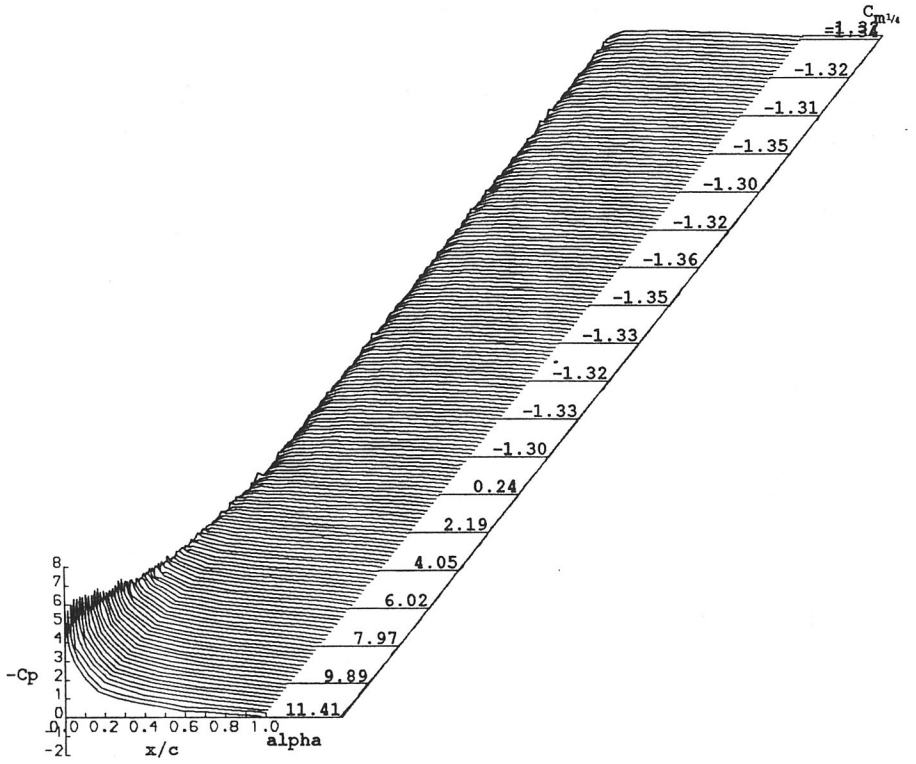


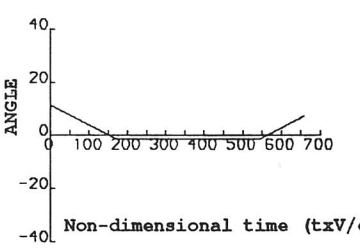


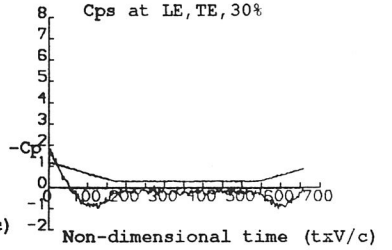


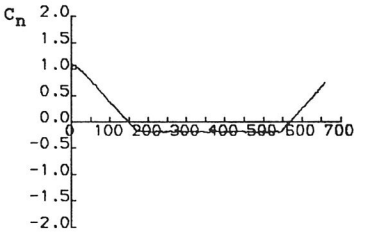
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

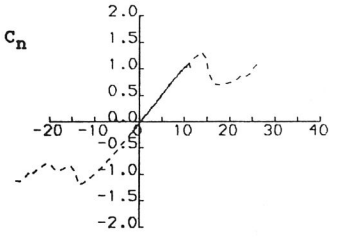
RUN REFERENCE NUMBER: 30631
DATE OF TEST: 17/12/90
REYNOLDS NUMBER = 1466482.
MACH NUMBER = 0.118
DYNAMIC PRESSURE = 1004.05 Nm^{-2}
AIR TEMPERATURE = 29.6°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 29.00 Hz.
MOTION TYPE: RAMP DOWN
REDUCED PITCH RATE = -0.00065
START ANGLE = 40.00°
LINEAR PITCH RATE = $-5.61°s^{-1}$
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

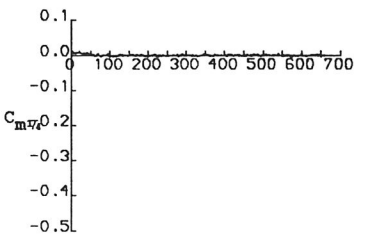


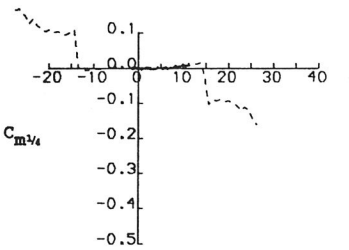


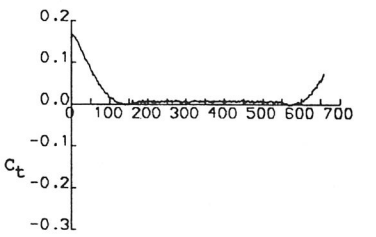


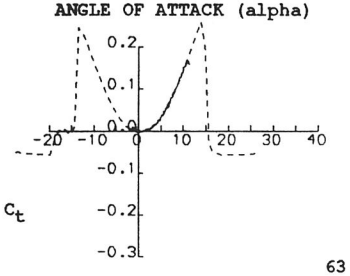








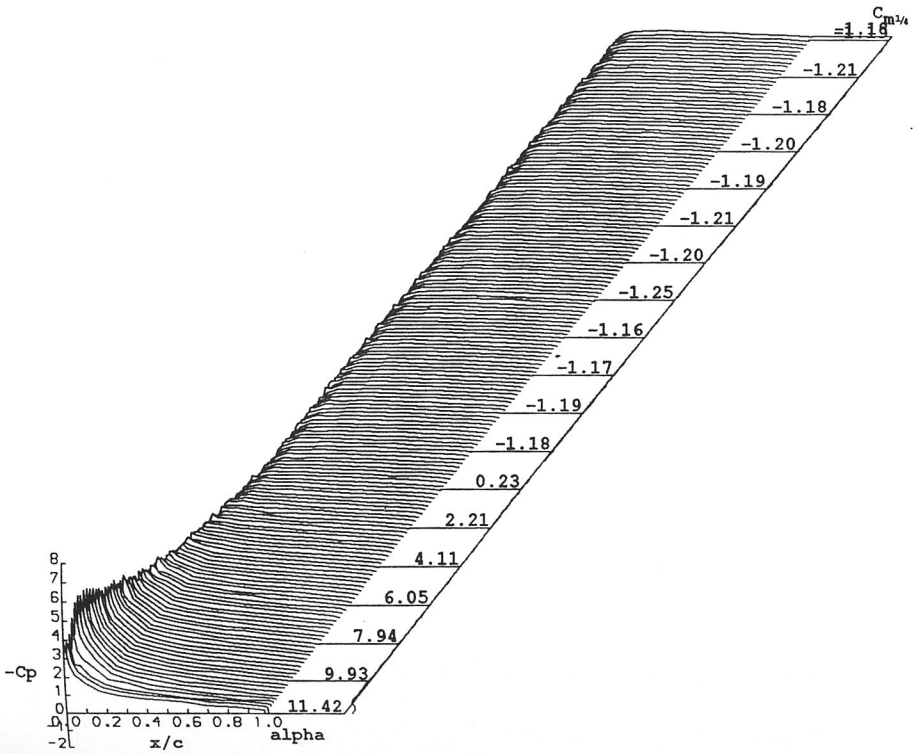


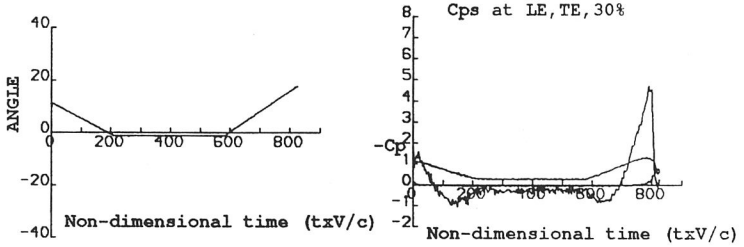


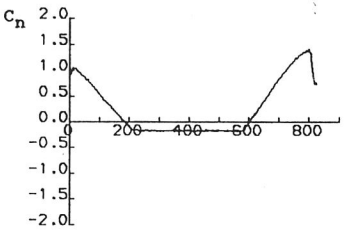
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

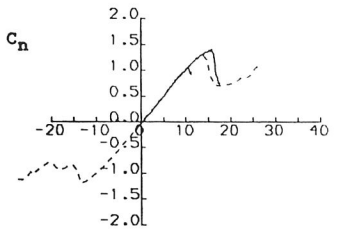
RUN REFERENCE NUMBER: 30641
REYNOLDS NUMBER = 1464341.
DYNAMIC PRESSURE = 996.90 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

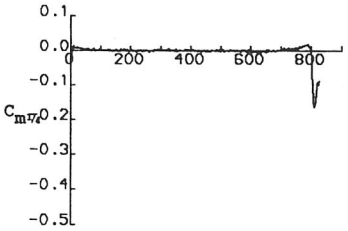
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 29.1°C
SAMPLING FREQUENCY = 23.00 Hz.
REDUCED PITCH RATE = -0.00052
LINEAR PITCH RATE = $-4.46°S^{-1}$

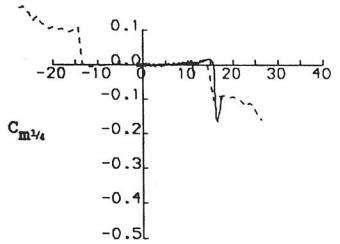


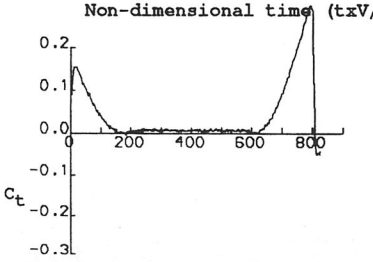


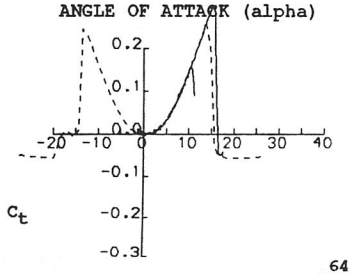








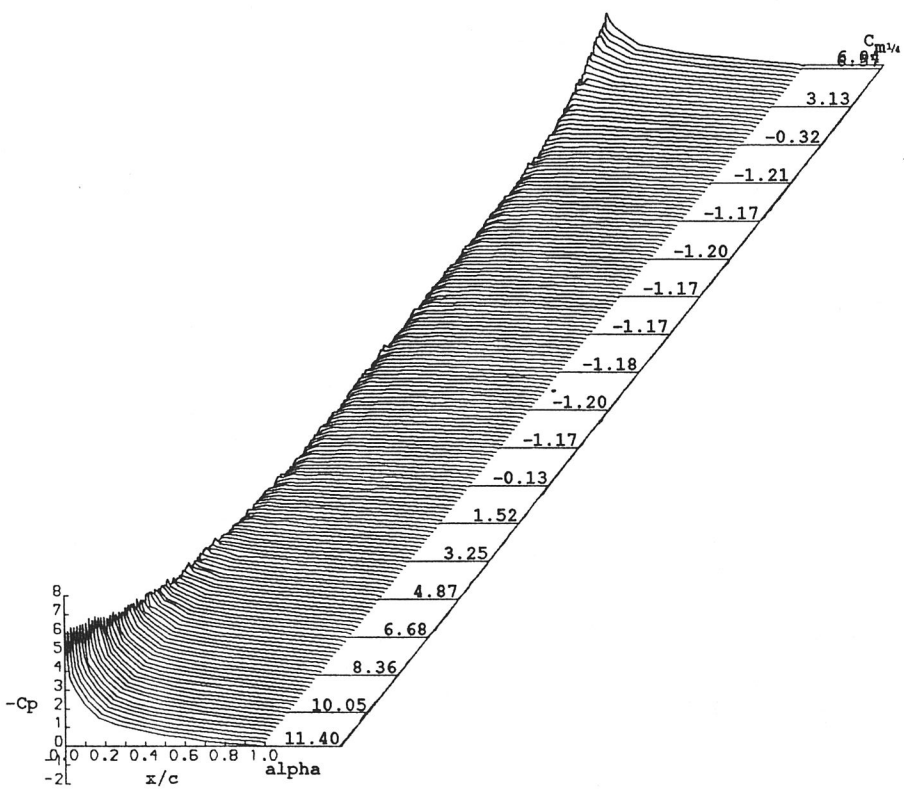


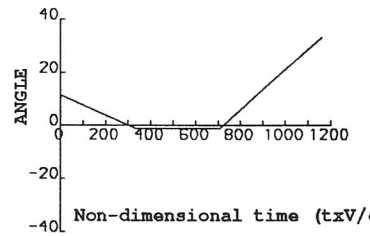


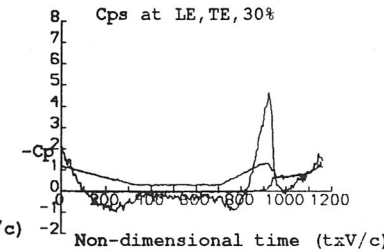
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

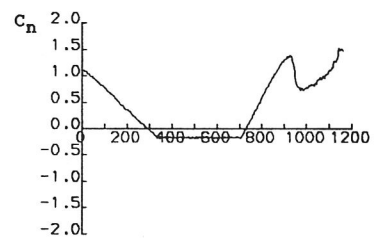
RUN REFERENCE NUMBER: 30651
REYNOLDS NUMBER = 1459400.
DYNAMIC PRESSURE = 996.90 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

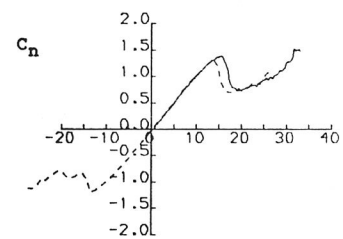
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 29.9°C
SAMPLING FREQUENCY = 16.40 Hz.
REDUCED PITCH RATE = 0.00026
LINEAR PITCH RATE = 2.24°S^{-1}

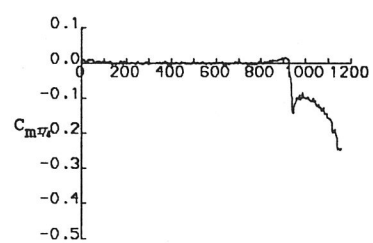


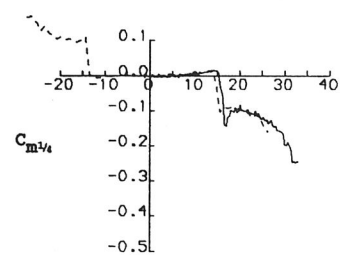


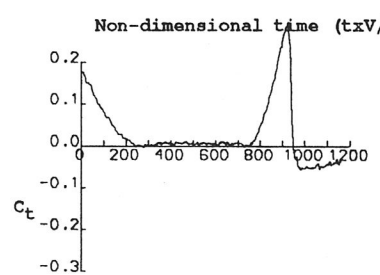


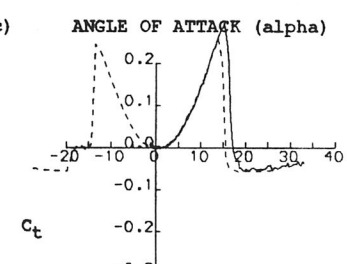








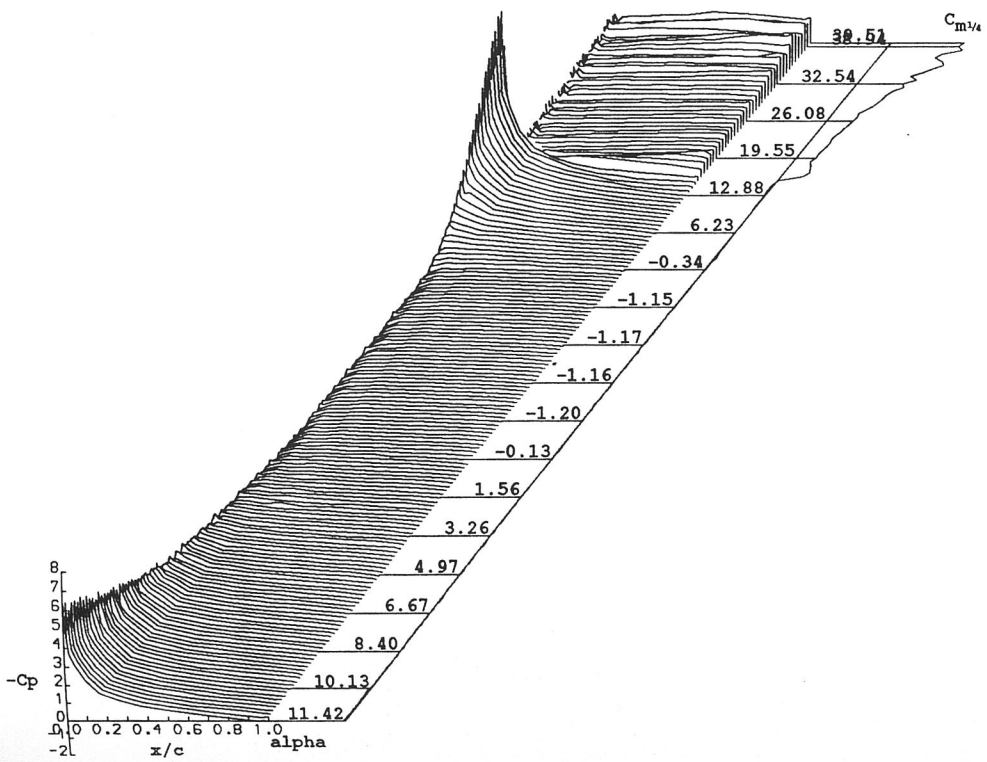


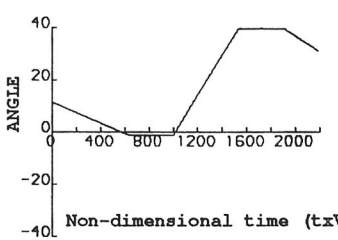


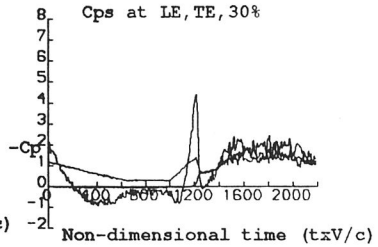
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

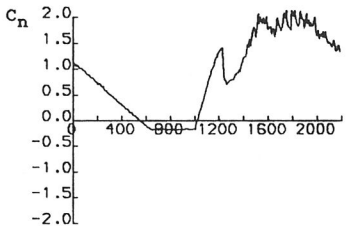
RUN REFERENCE NUMBER: 30661
REYNOLDS NUMBER = 1456327.
DYNAMIC PRESSURE = 996.90 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

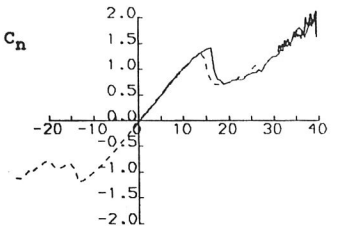
DATE OF TEST: 17/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 30.4°C
SAMPLING FREQUENCY = 8.70 Hz.
REDUCED PITCH RATE = 0.00030
LINEAR PITCH RATE = 2.59°S^{-1}

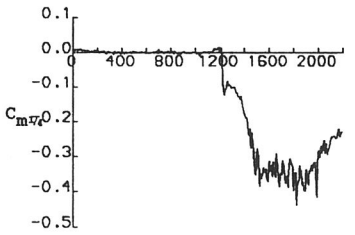


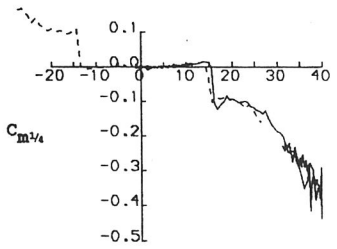


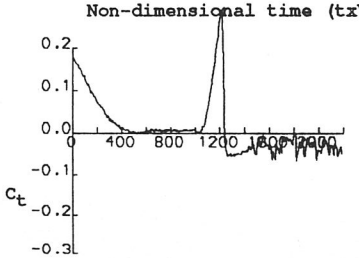


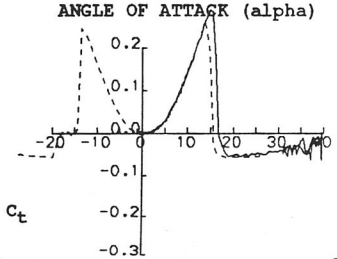








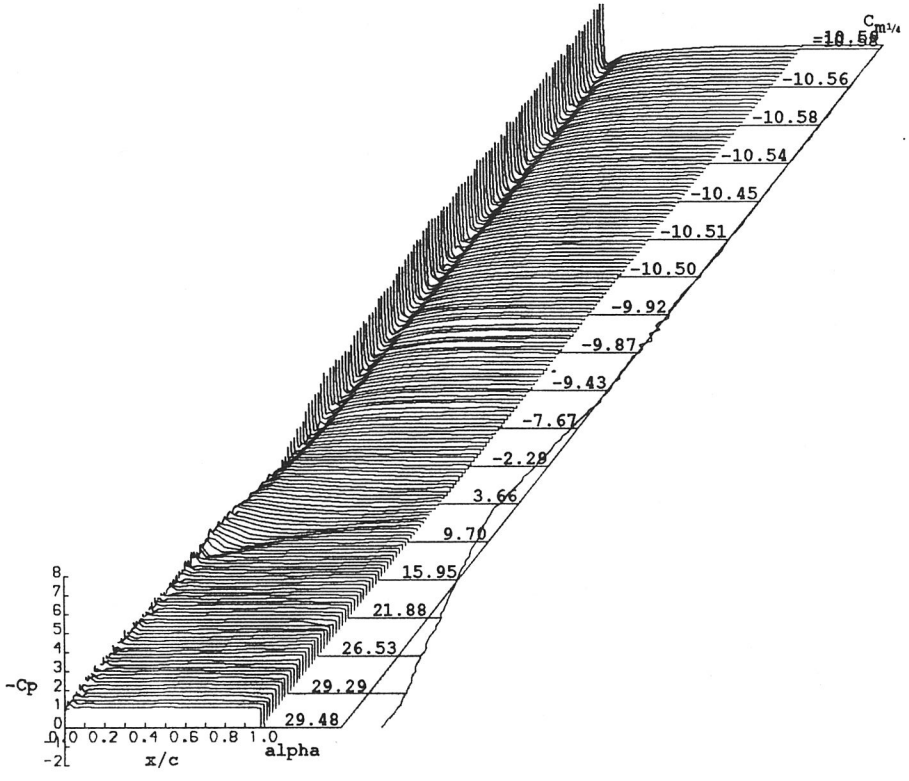


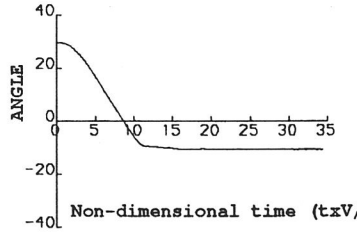


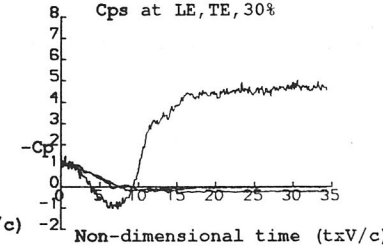
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

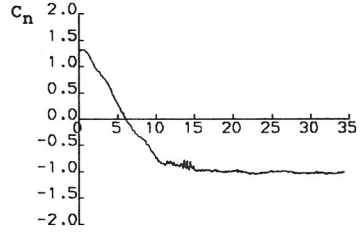
RUN REFERENCE NUMBER: 30671
REYNOLDS NUMBER = 1526569.
DYNAMIC PRESSURE = 1010.31 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 30.00°
RAMP ARC = -40.000°
AVERAGED DATA OF 5 CYCLES

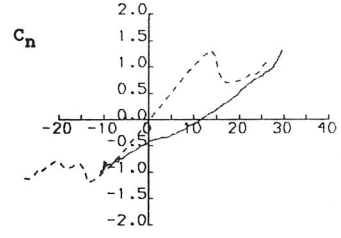
DATE OF TEST: 18/12/90
MACH NUMBER = 0.119
AIR TEMPERATURE = 20.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03997
LINEAR PITCH RATE = $-340.06°S^{-1}$

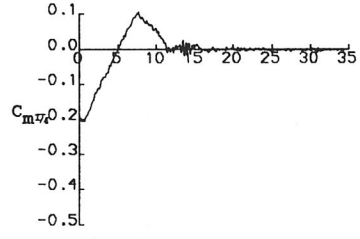


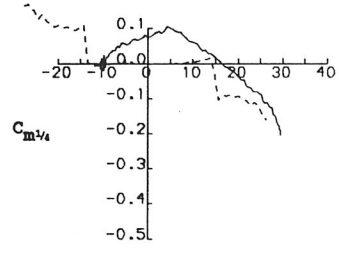


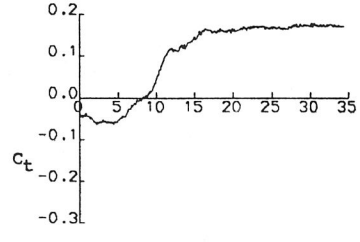


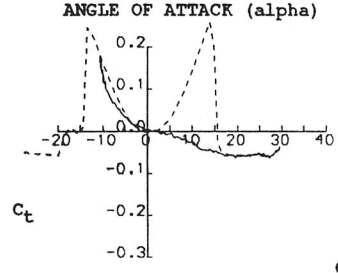








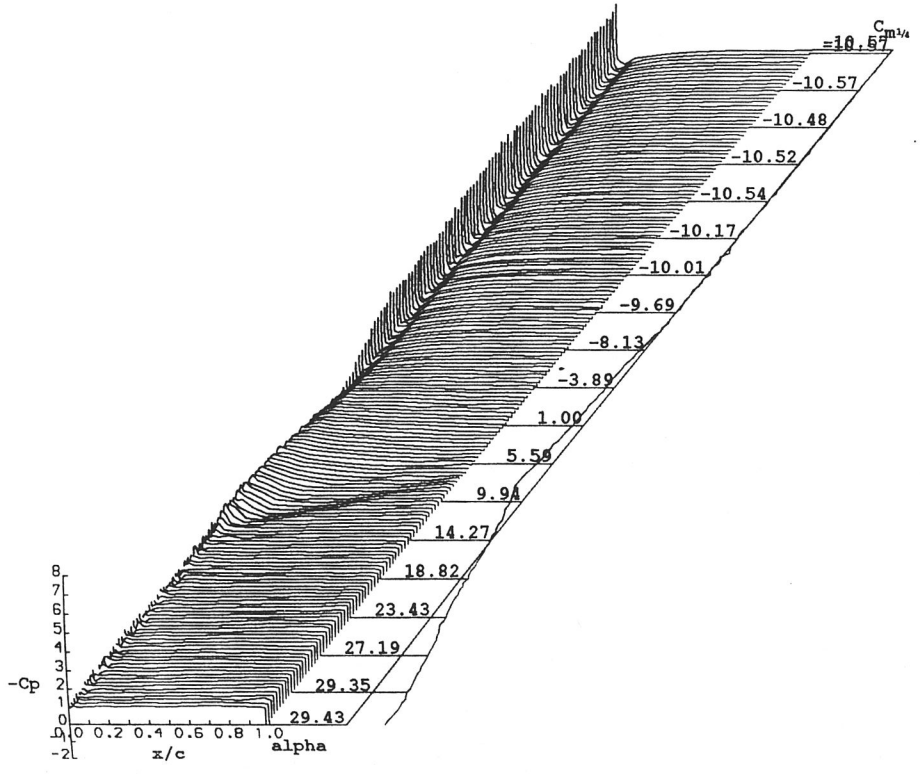


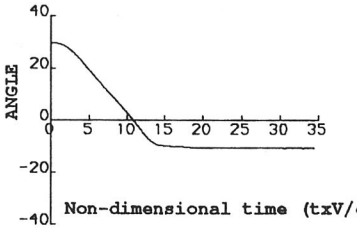


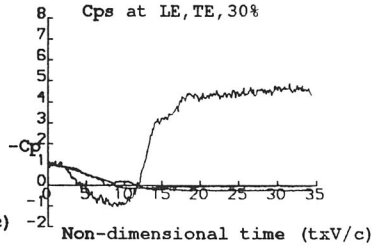
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

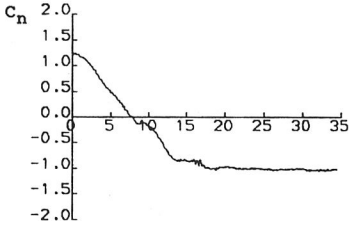
RUN REFERENCE NUMBER: 30681
REYNOLDS NUMBER = 1519909.
DYNAMIC PRESSURE = 1010.31 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 30.00°
RAMP ARC = -40.000°
AVERAGED DATA OF 5 CYCLES

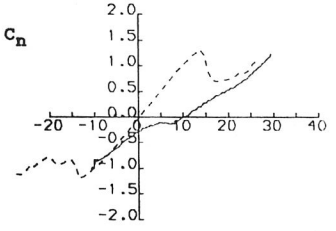
DATE OF TEST: 18/12/90
MACH NUMBER = 0.119
AIR TEMPERATURE = 21.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02844
LINEAR PITCH RATE = -242.35°S^{-1}

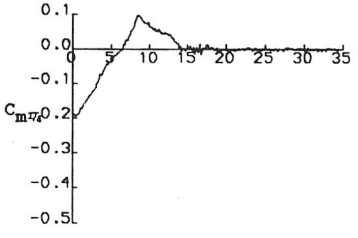


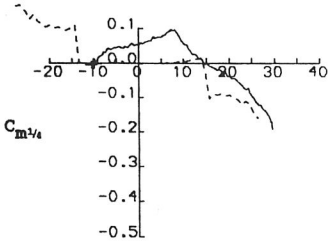


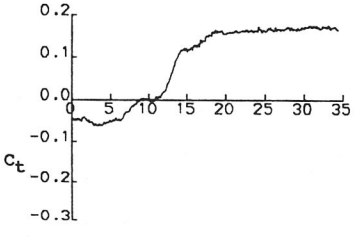


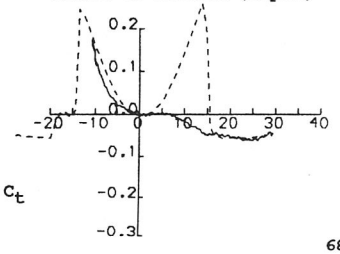








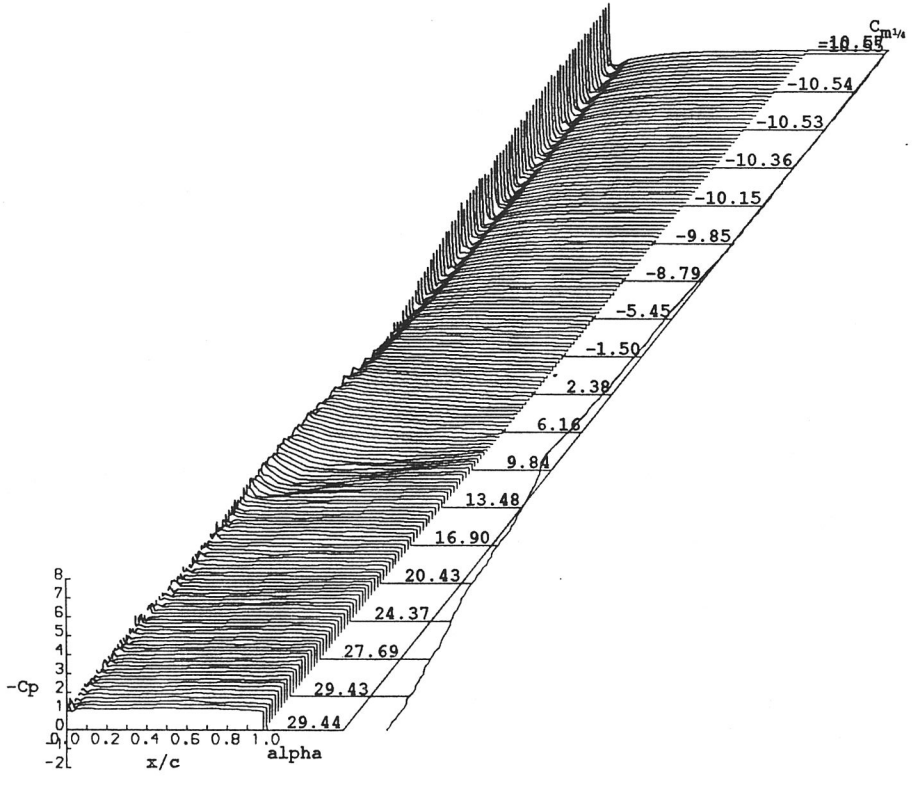


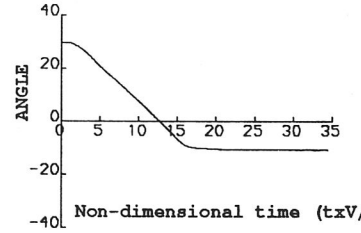


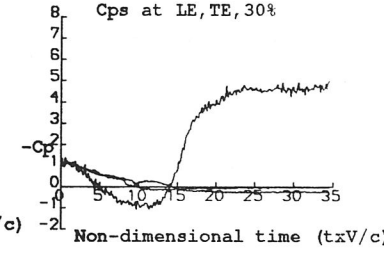
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

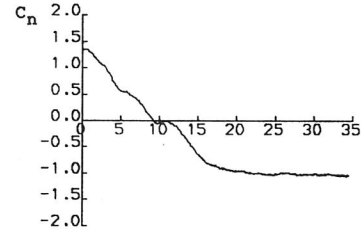
RUN REFERENCE NUMBER: 30691
REYNOLDS NUMBER = 1514621.
DYNAMIC PRESSURE = 1010.31 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 30.00°
RAMP ARC = -40.000°
AVERAGED DATA OF 5 CYCLES

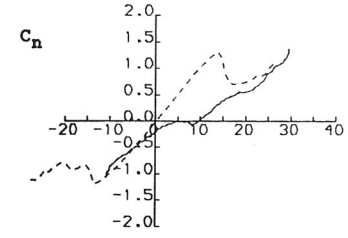
DATE OF TEST: 18/12/90
MACH NUMBER = 0.119
AIR TEMPERATURE = 22.0°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02265
LINEAR PITCH RATE = $-193.30°S^{-1}$

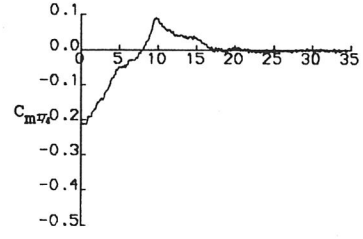


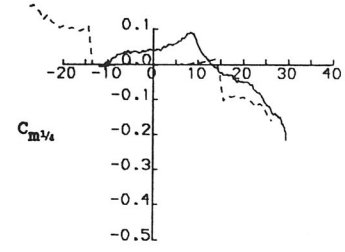


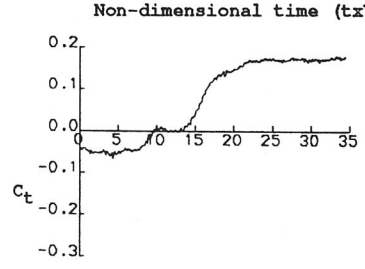


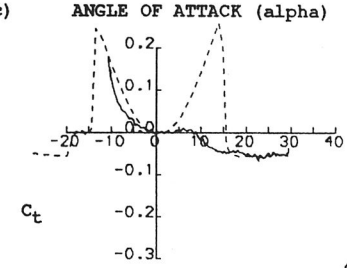








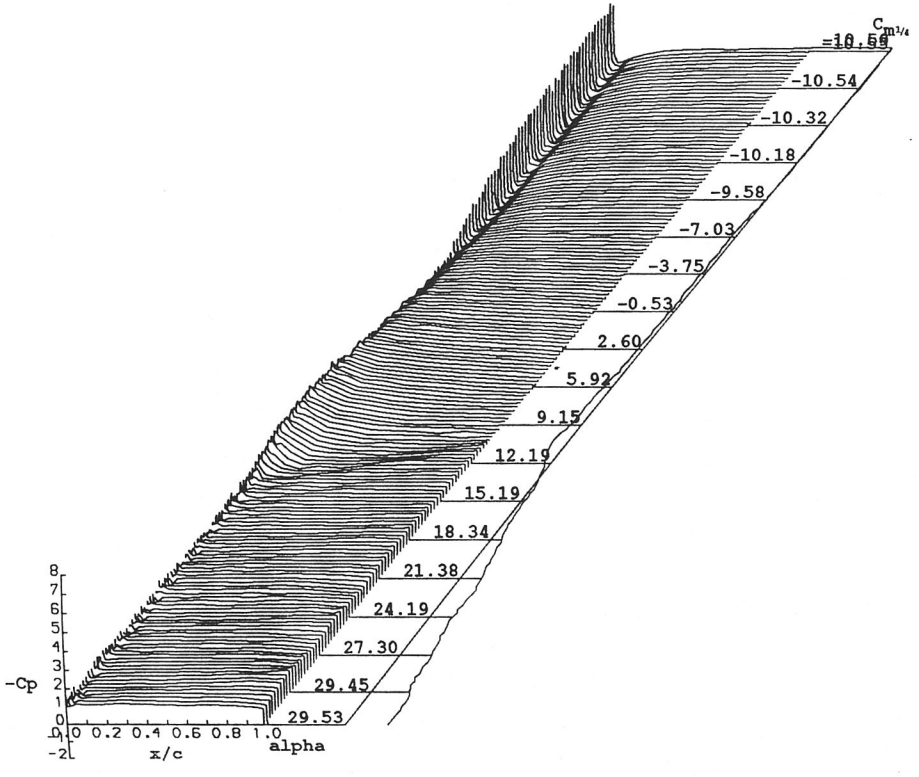


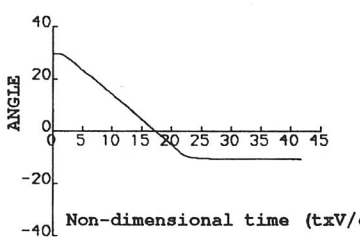


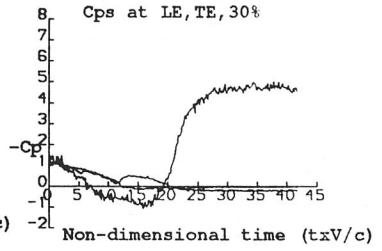
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

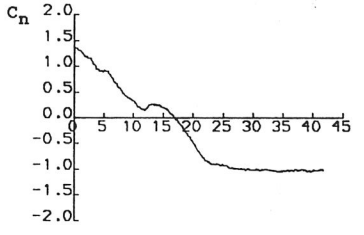
RUN REFERENCE NUMBER: 30701
REYNOLDS NUMBER = 1504731.
DYNAMIC PRESSURE = 992.83 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 30.00°
RAMP ARC = -40.000°
AVERAGED DATA OF 5 CYCLES

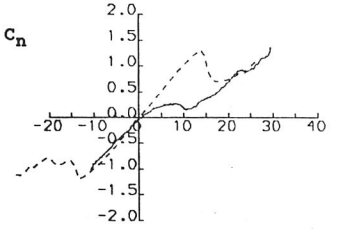
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 21.5°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = -0.01655
LINEAR PITCH RATE = $-139.91°S^{-1}$

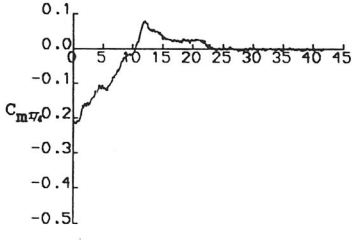


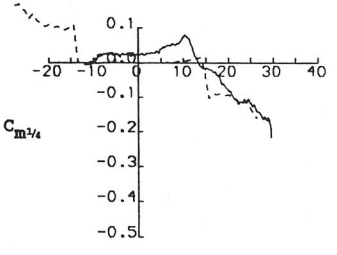


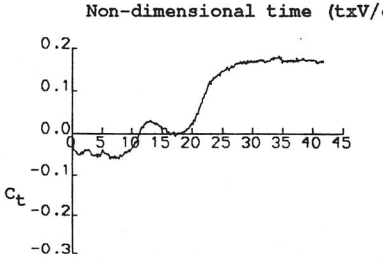


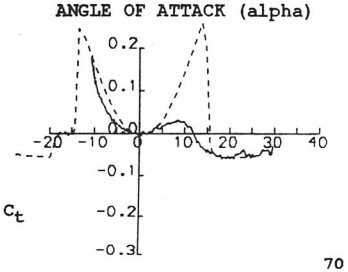








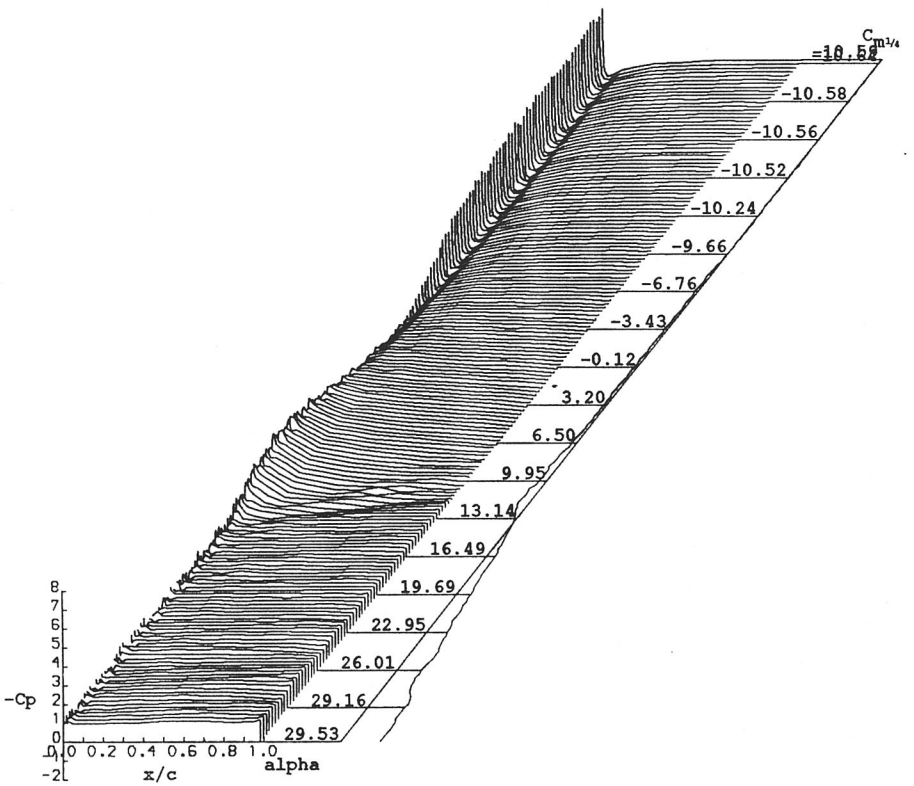


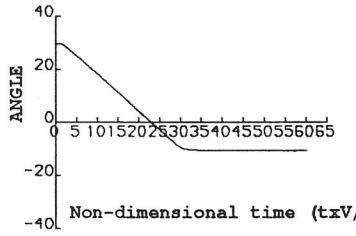


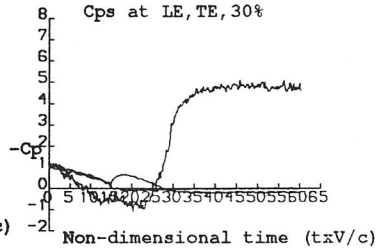
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

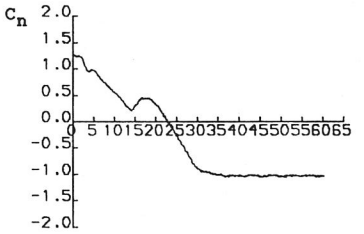
RUN REFERENCE NUMBER: 30711
REYNOLDS NUMBER = 1496900.
DYNAMIC PRESSURE = 992.83 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 30.00°
RAMP ARC = -40.000°
AVERAGED DATA OF 5 CYCLES

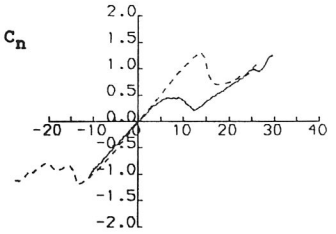
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 22.7°C
SAMPLING FREQUENCY = 312.01 Hz.
REDUCED PITCH RATE = -0.01186
LINEAR PITCH RATE = $-100.44°S^{-1}$

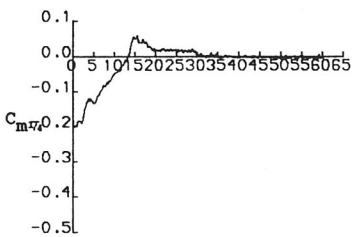


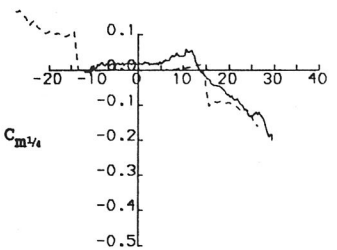


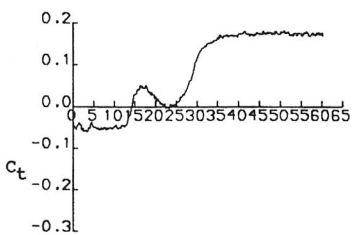


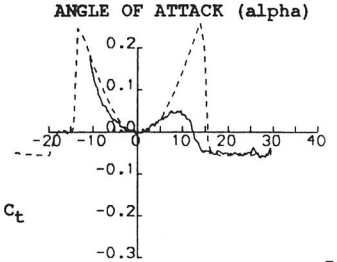








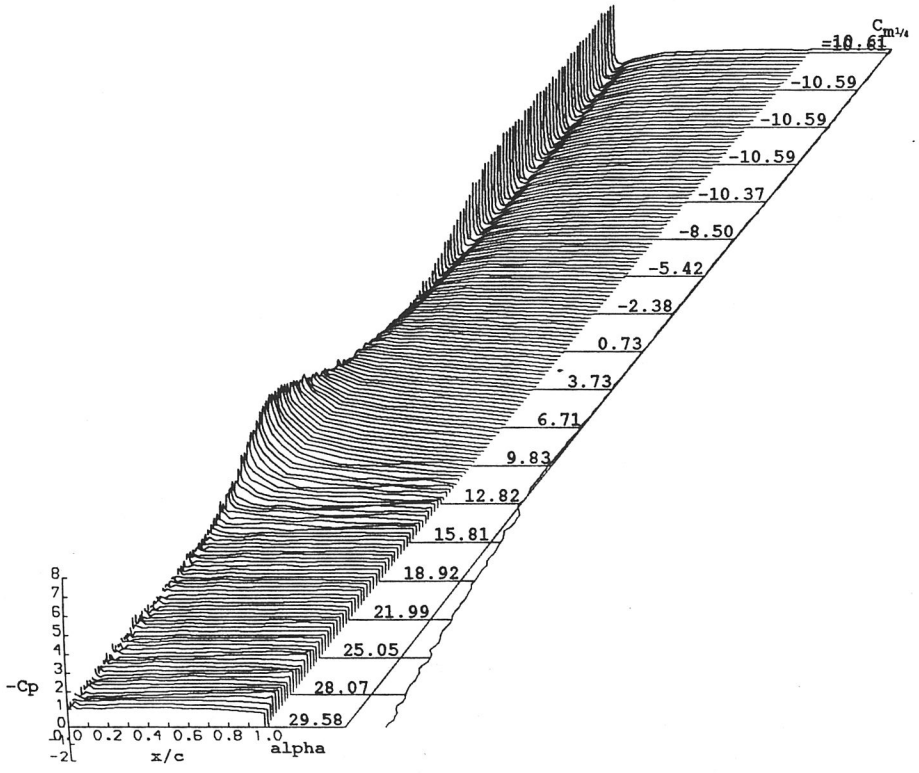


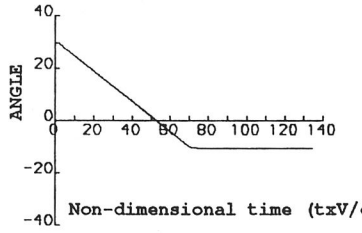


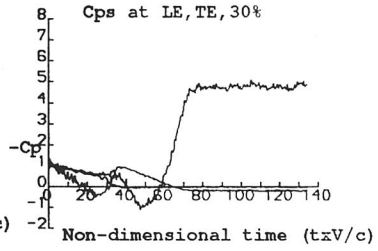
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

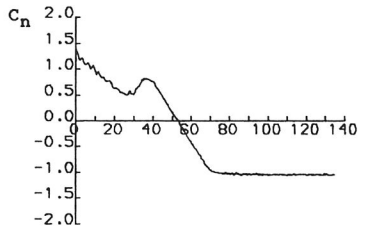
RUN REFERENCE NUMBER: 30721
REYNOLDS NUMBER = 1492367.
DYNAMIC PRESSURE = 992.83 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 30.00°
RAMP ARC = -40.000°
AVERAGED DATA OF 5 CYCLES

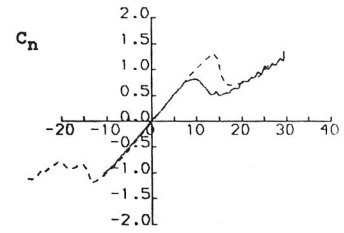
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.4°C
SAMPLING FREQUENCY = 140.00 Hz.
REDUCED PITCH RATE = -0.00498
LINEAR PITCH RATE = $-42.26°s^{-1}$

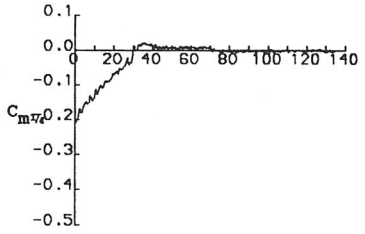


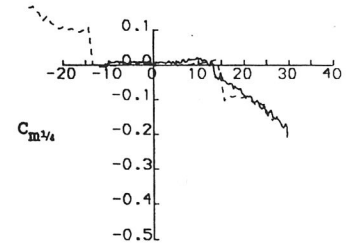


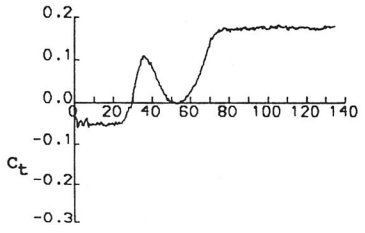


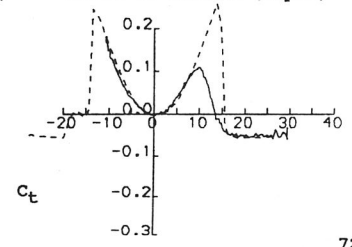








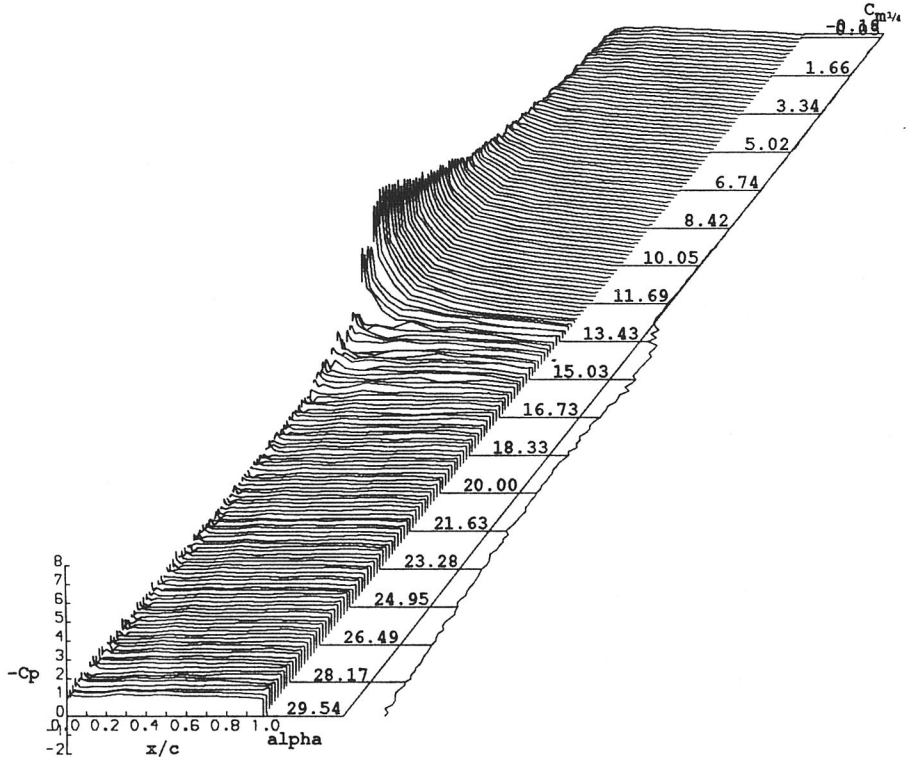


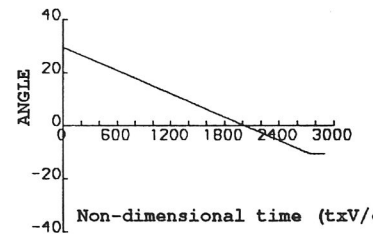


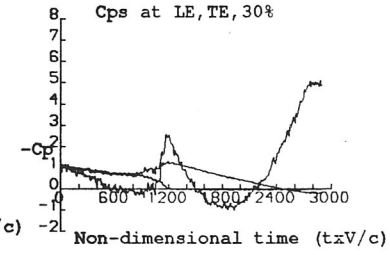
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

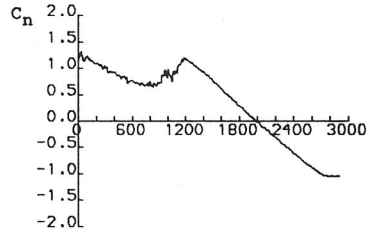
RUN REFERENCE NUMBER: 30731
REYNOLDS NUMBER = 1489146.
DYNAMIC PRESSURE = 992.83 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 30.00°
RAMP ARC = -40.000°
AVERAGED DATA OF 5 CYCLES

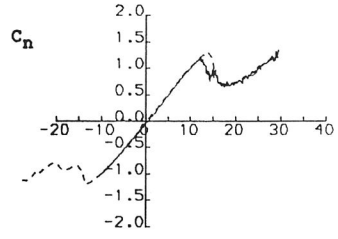
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.9°C
SAMPLING FREQUENCY = 6.50 Hz.
REDUCED PITCH RATE = -0.00013
LINEAR PITCH RATE = $-1.09°S^{-1}$

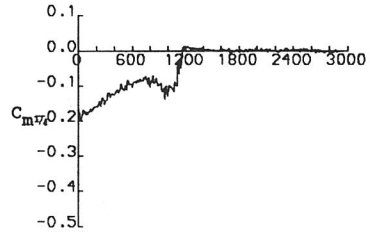


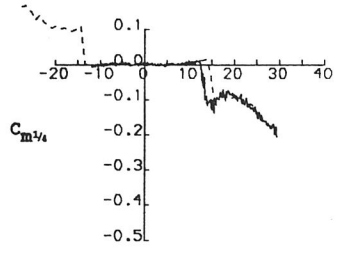


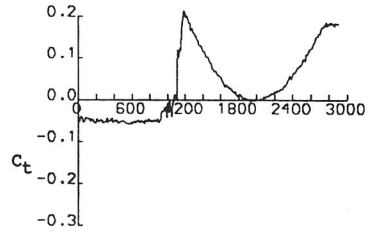


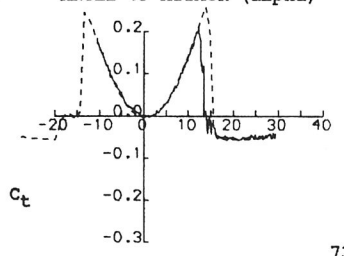








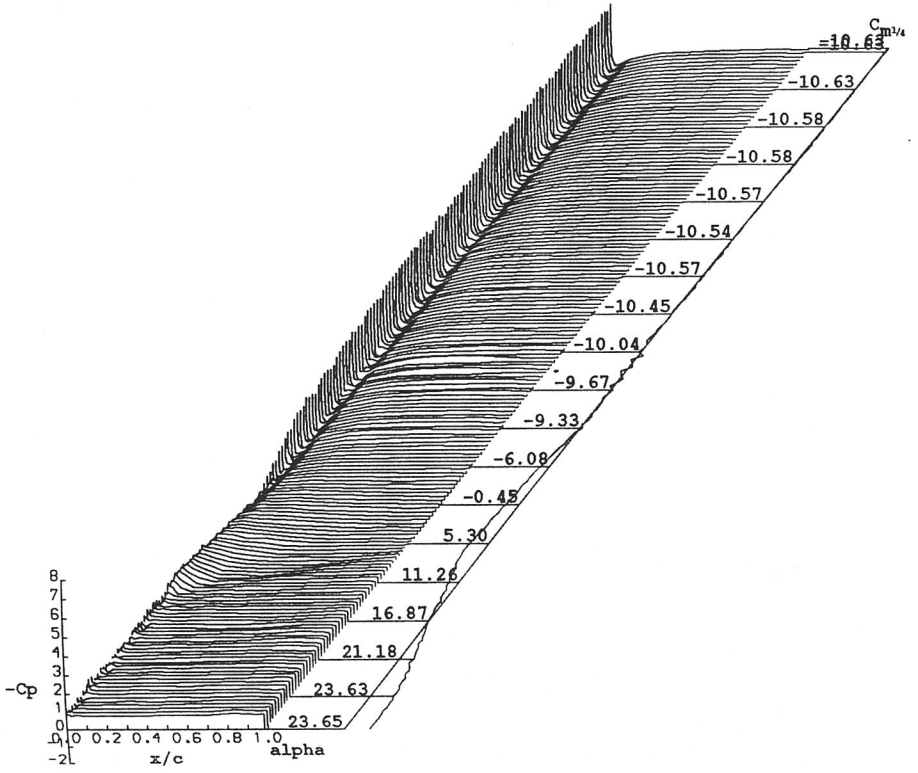


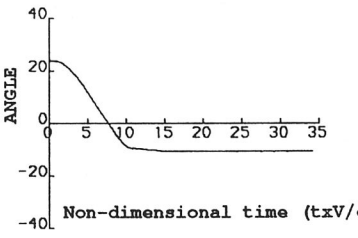


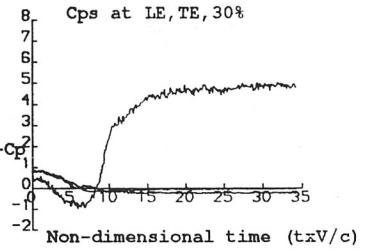
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

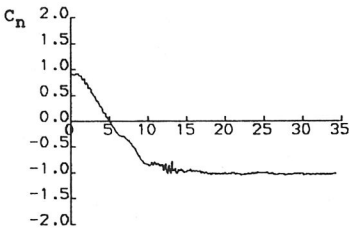
RUN REFERENCE NUMBER: 30741
REYNOLDS NUMBER = 1484089.
DYNAMIC PRESSURE = 990.36 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 24.00°
RAMP ARC = -34.000°
AVERAGED DATA OF 5 CYCLES

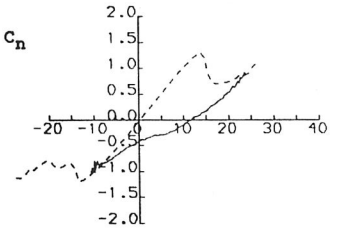
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.4°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03820
LINEAR PITCH RATE = $-324.07°S^{-1}$

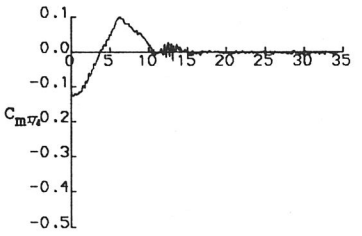


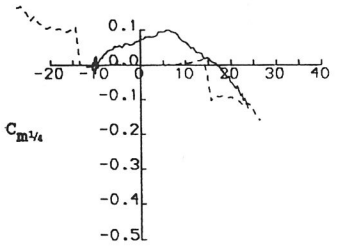


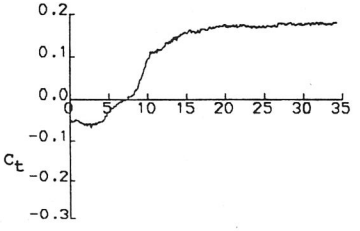


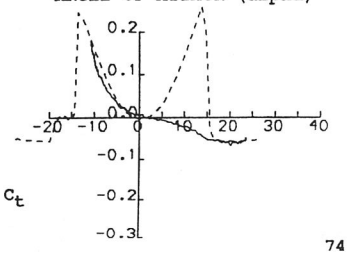






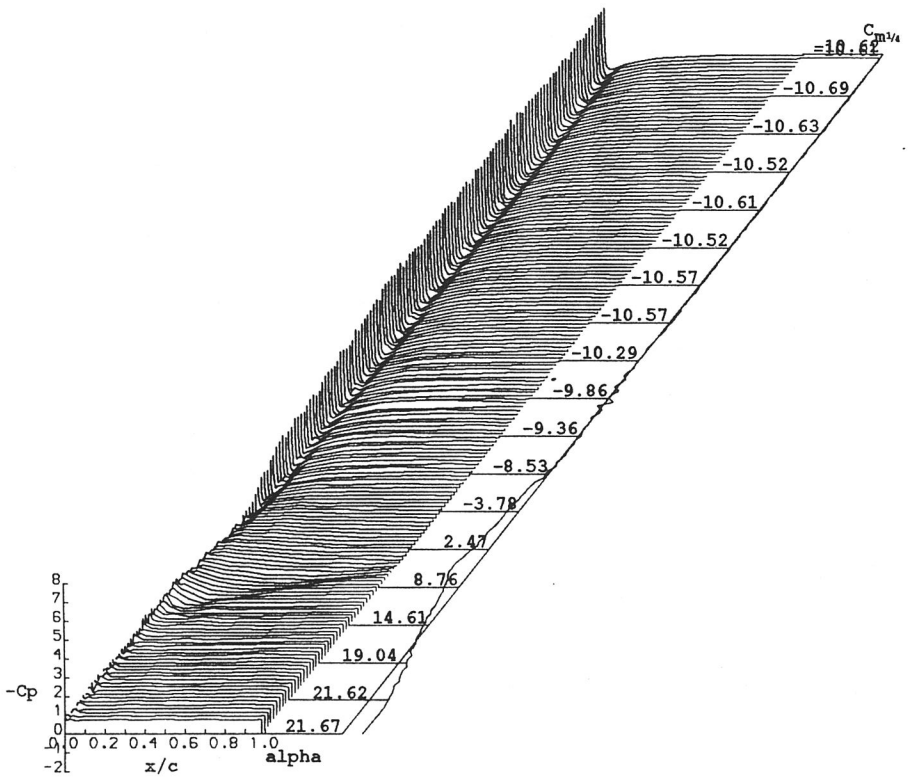


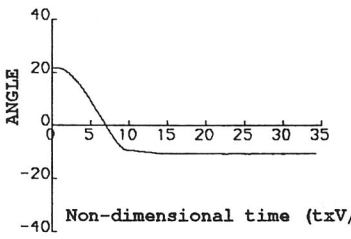


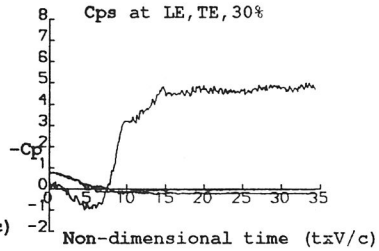


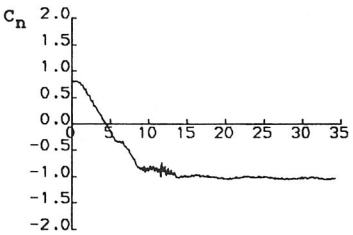
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

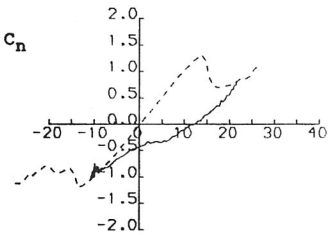
RUN REFERENCE NUMBER: 30751
DATE OF TEST: 18/12/90
REYNOLDS NUMBER = 1479625.
MACH NUMBER = 0.118
DYNAMIC PRESSURE = 990.36 Nm^{-2}
AIR TEMPERATURE = 25.1°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 550.05 Hz.
MOTION TYPE: RAMP DOWN
REDUCED PITCH RATE = -0.03965
START ANGLE = 22.00°
LINEAR PITCH RATE = -336.82°S^{-1}
RAMP ARC = -32.000°
AVERAGED DATA OF 5 CYCLES

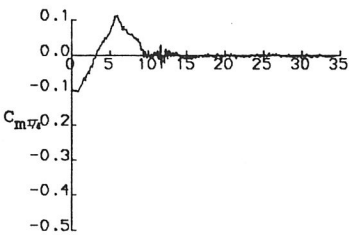


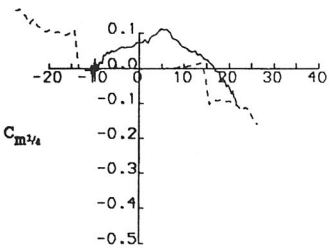


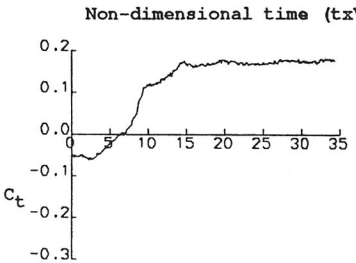


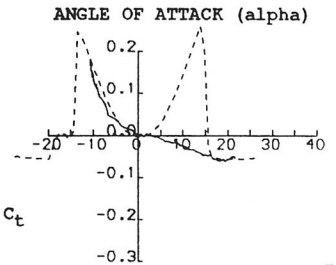








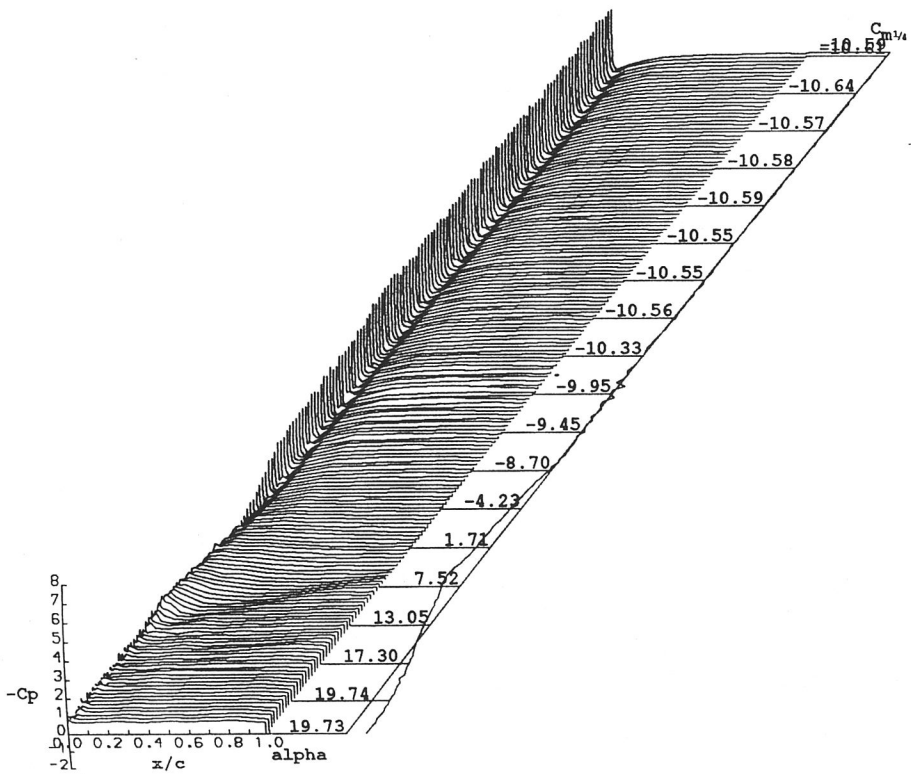


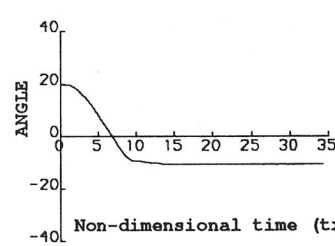


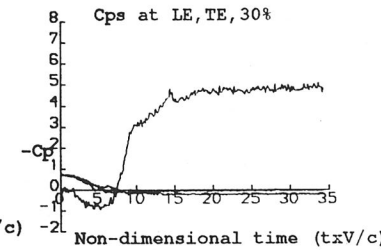
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

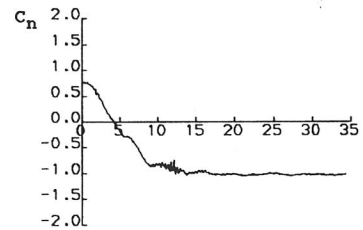
RUN REFERENCE NUMBER: 30761
REYNOLDS NUMBER = 1478354.
DYNAMIC PRESSURE = 990.36 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 20.00°
RAMP ARC = -30.000°
AVERAGED DATA OF 5 CYCLES

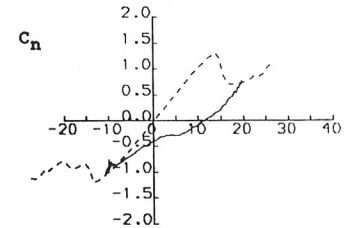
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03737
LINEAR PITCH RATE = $-317.48°S^{-1}$

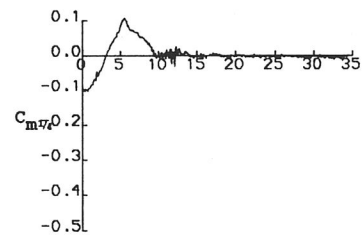


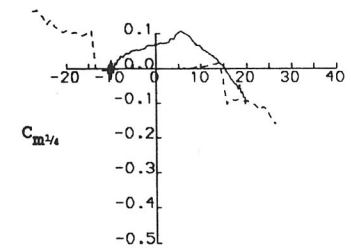


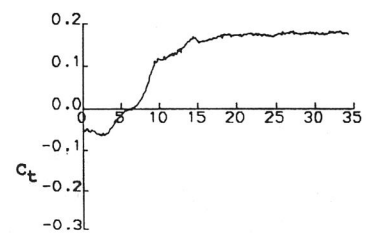


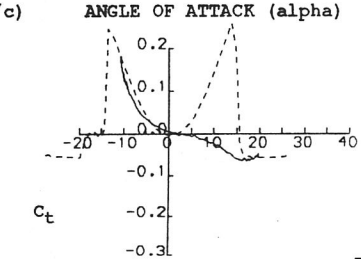








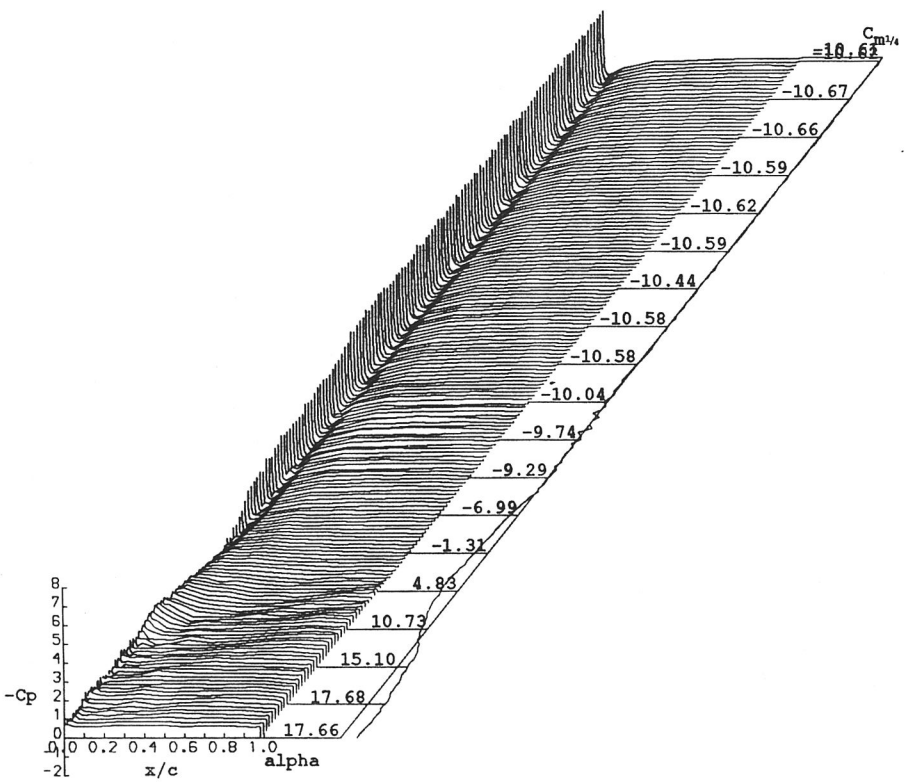


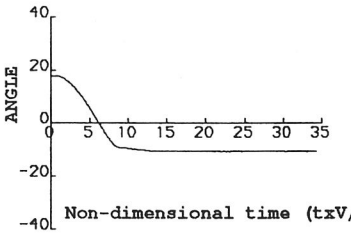


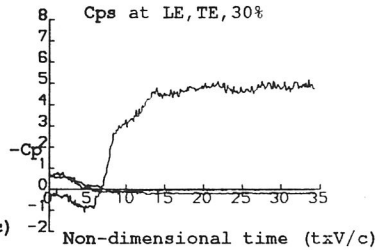
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

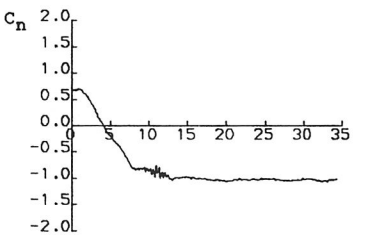
RUN REFERENCE NUMBER: 30771
REYNOLDS NUMBER = 1476452.
DYNAMIC PRESSURE = 990.36 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 18.00°
RAMP ARC = -28.000°
AVERAGED DATA OF 5 CYCLES

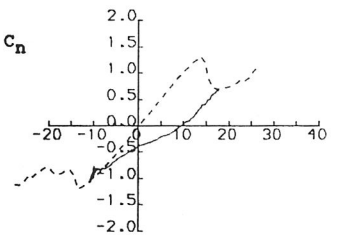
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.6°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03912
LINEAR PITCH RATE = $-332.55°S^{-1}$

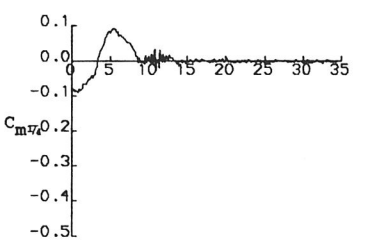


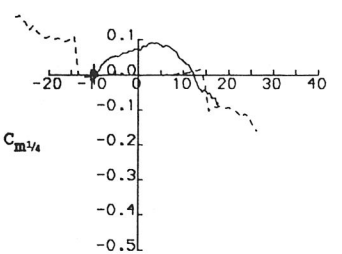


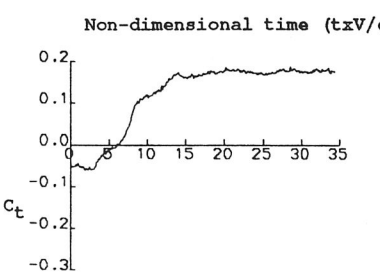


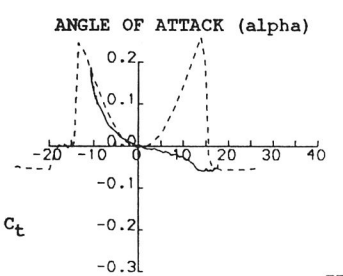








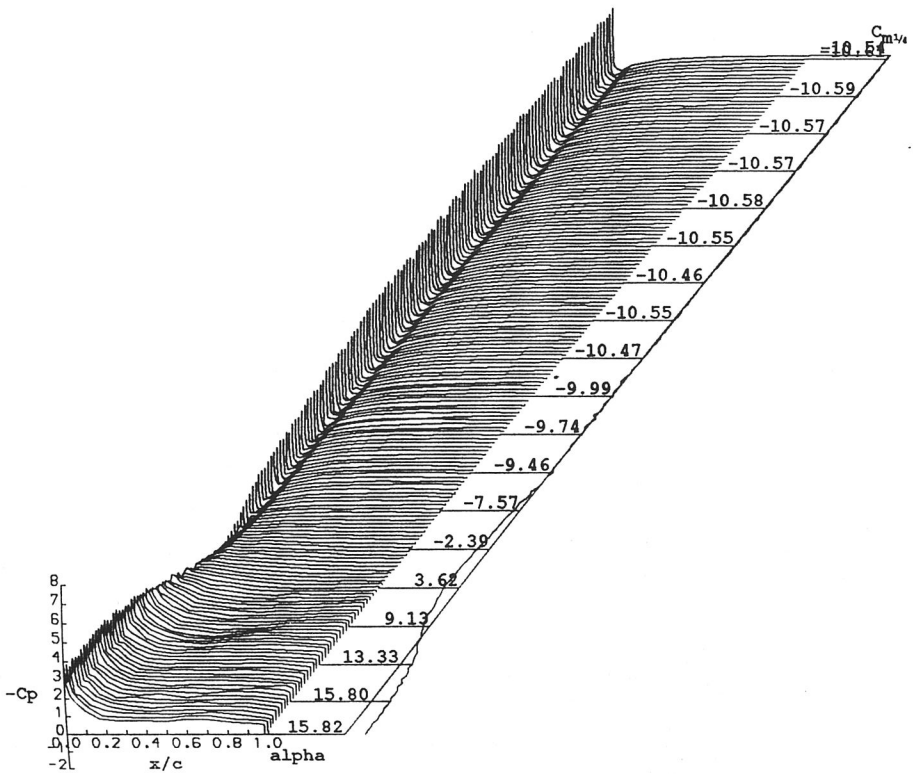


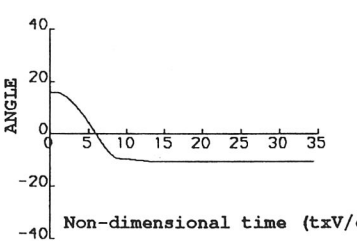


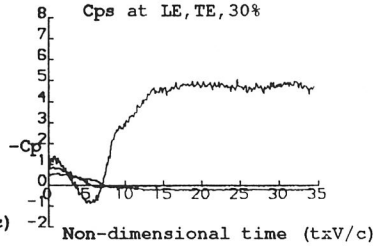
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

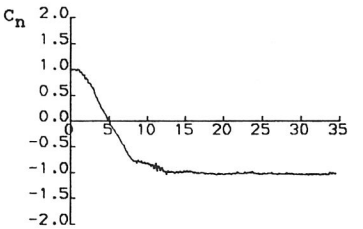
RUN REFERENCE NUMBER: 30781
REYNOLDS NUMBER = 1482727.
DYNAMIC PRESSURE = 999.65 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 16.00°
RAMP ARC = -26.000°
AVERAGED DATA OF 5 CYCLES

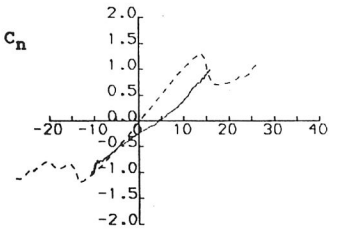
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03602
LINEAR PITCH RATE = -307.68°S^{-1}

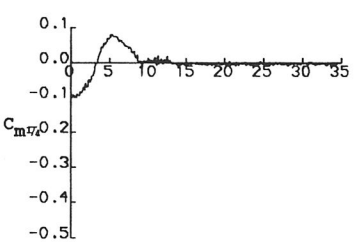


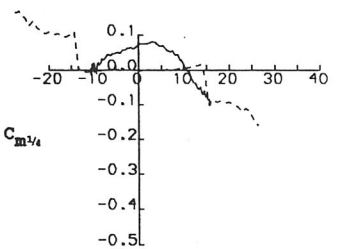


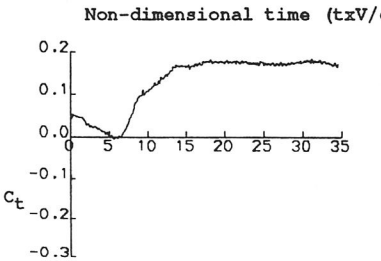


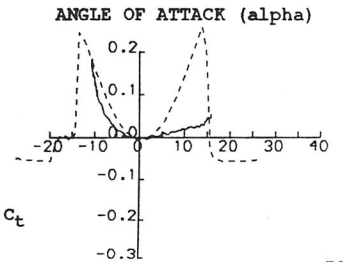








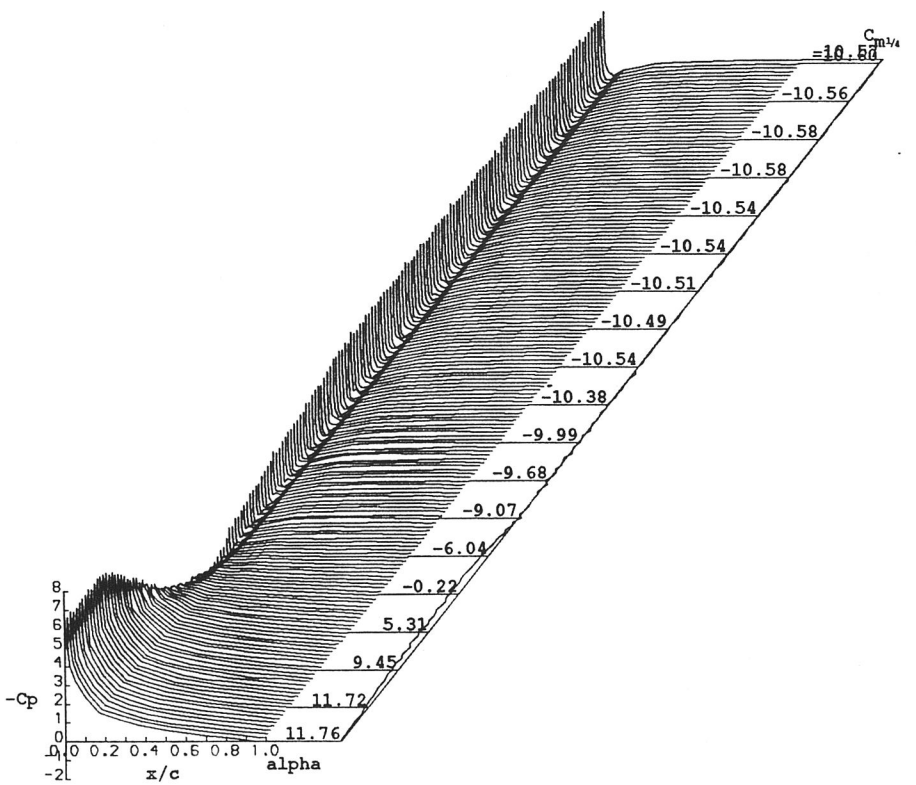


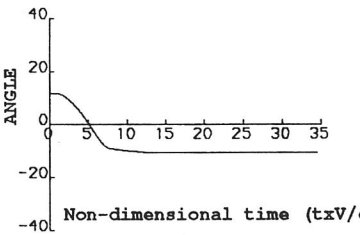


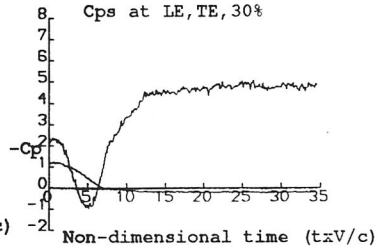
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

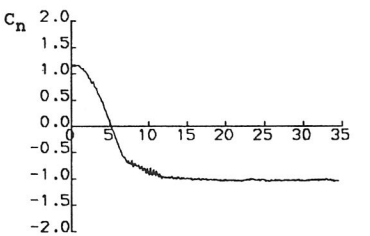
RUN REFERENCE NUMBER: 30791
REYNOLDS NUMBER = 1477658.
DYNAMIC PRESSURE = 999.65 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 12.00°
RAMP ARC = -22.000°
AVERAGED DATA OF 5 CYCLES

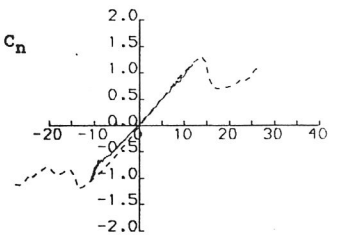
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 26.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03462
LINEAR PITCH RATE = -296.16°S^{-1}

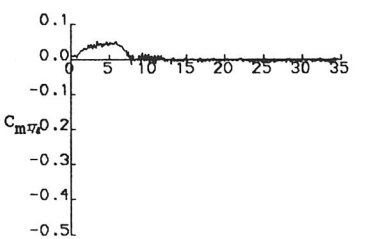


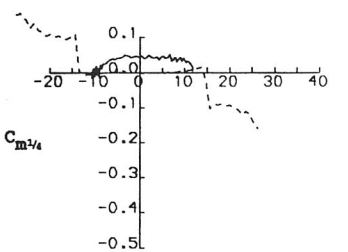


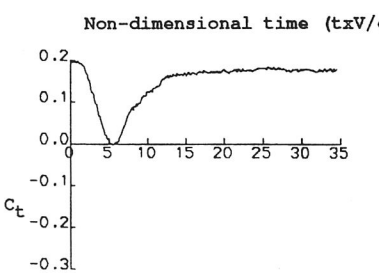


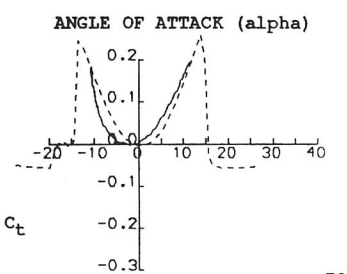








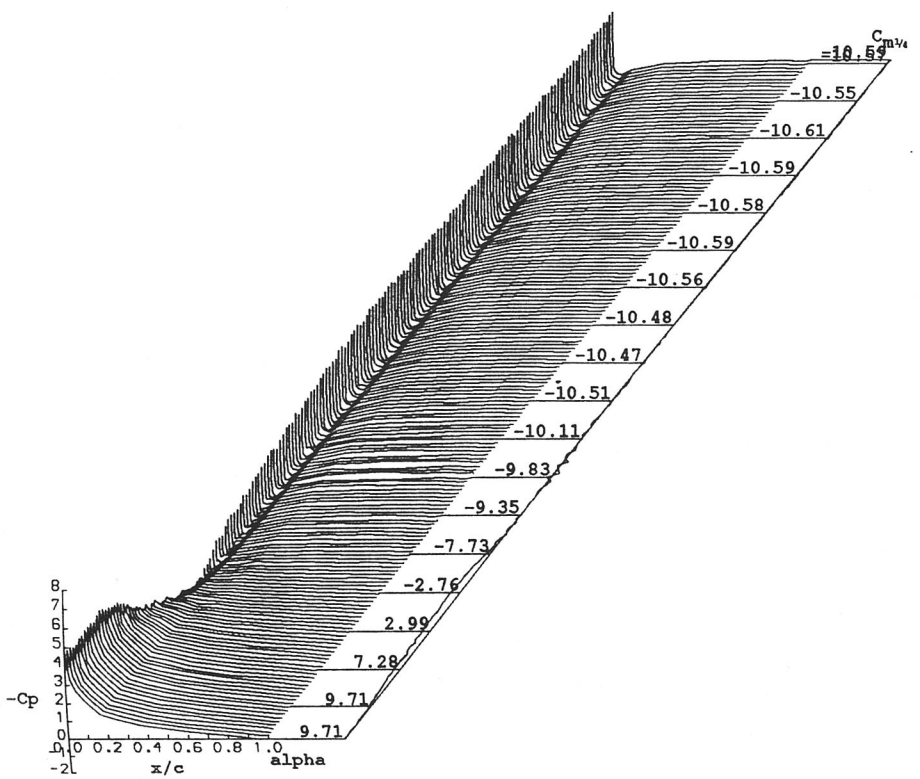


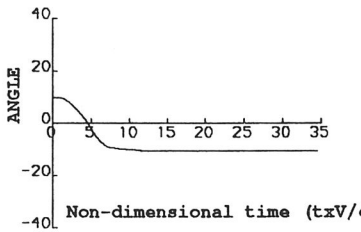


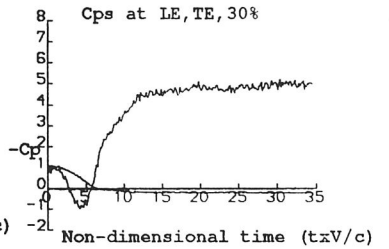
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

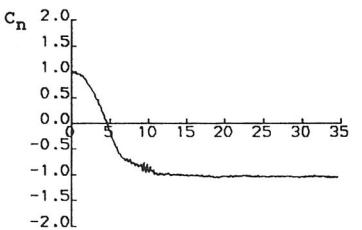
RUN REFERENCE NUMBER: 30801
REYNOLDS NUMBER = 1476395.
DYNAMIC PRESSURE = 999.65 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 10.00°
RAMP ARC = -20.000°
AVERAGED DATA OF 5 CYCLES

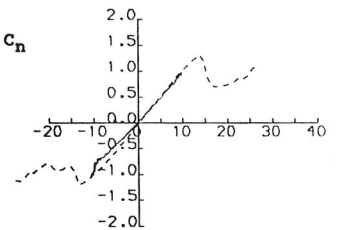
DATE OF TEST: 18/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 26.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03522
LINEAR PITCH RATE = $-301.38°S^{-1}$

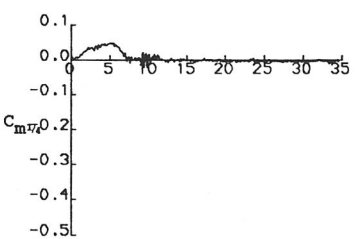


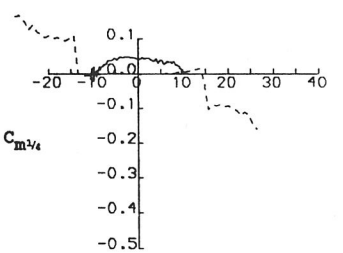


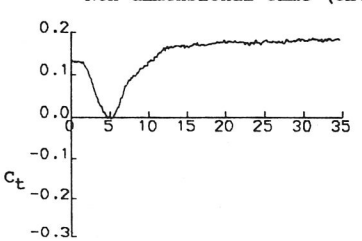


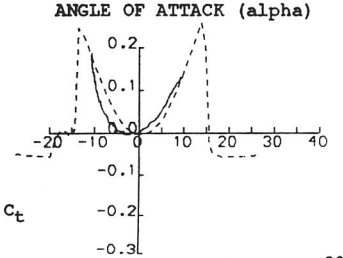








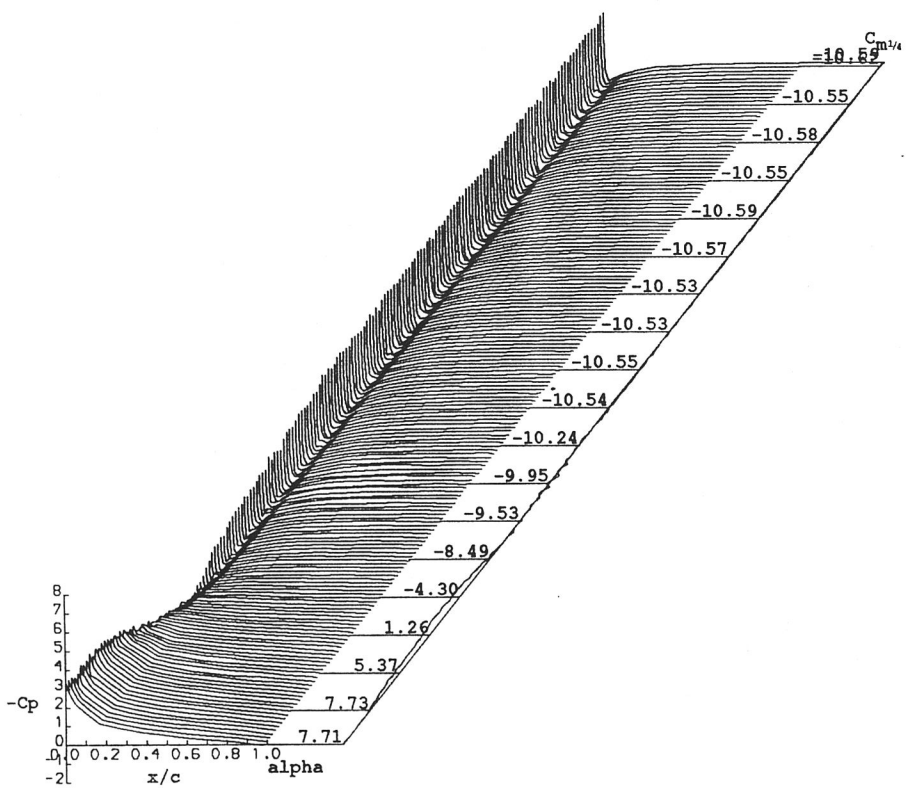


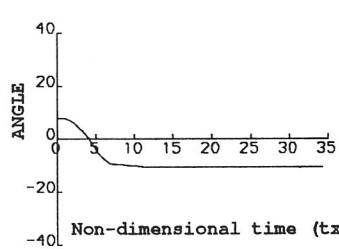


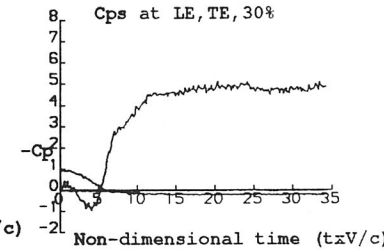
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

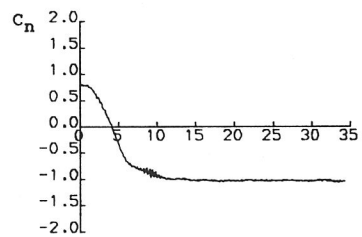
RUN REFERENCE NUMBER: 30811
REYNOLDS NUMBER = 1465740.
DYNAMIC PRESSURE = 985.28 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 8.00°
RAMP ARC = -18.000°
AVERAGED DATA OF 5 CYCLES

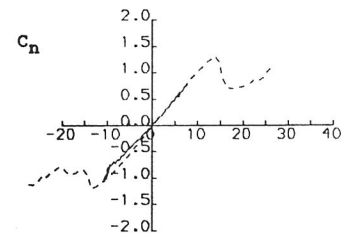
DATE OF TEST: 18/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03451
LINEAR PITCH RATE = $-293.18°S^{-1}$

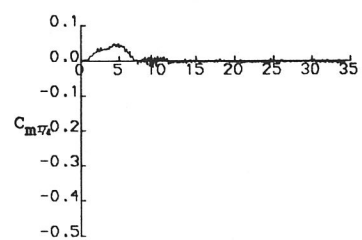


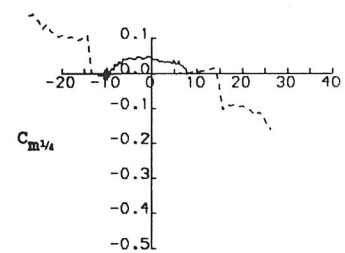


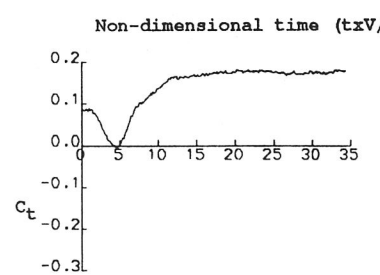


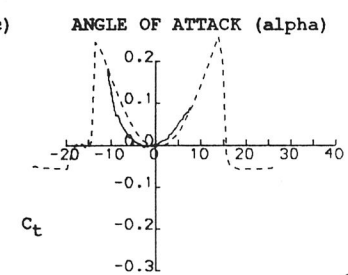








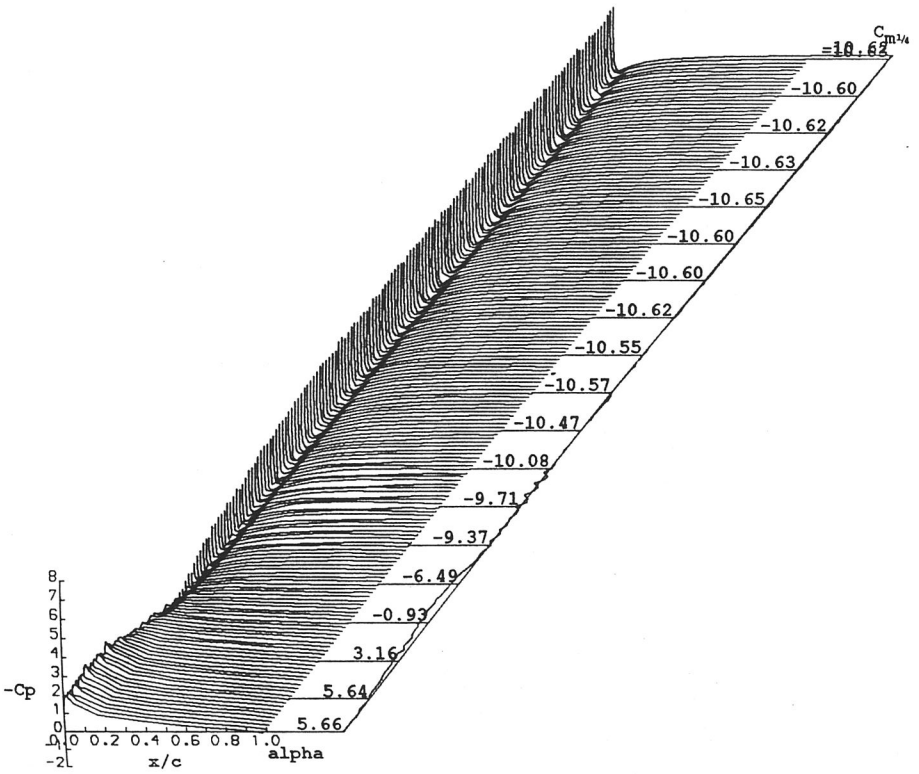


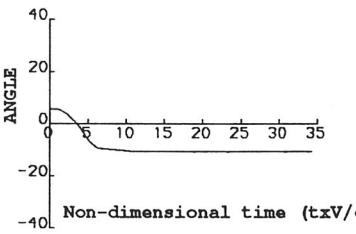


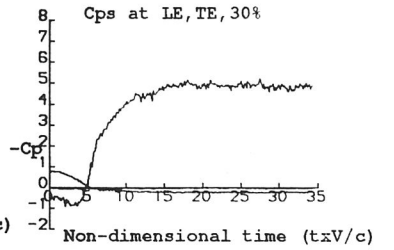
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

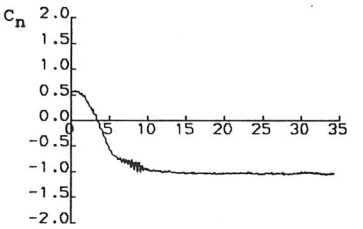
RUN REFERENCE NUMBER: 30821
REYNOLDS NUMBER = 1465115.
DYNAMIC PRESSURE = 985.28 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 6.00°
RAMP ARC = -16.000°
AVERAGED DATA OF 5 CYCLES

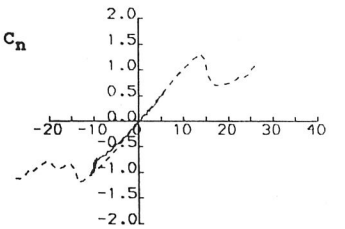
DATE OF TEST: 18/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.8°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03255
LINEAR PITCH RATE = $-276.56°S^{-1}$

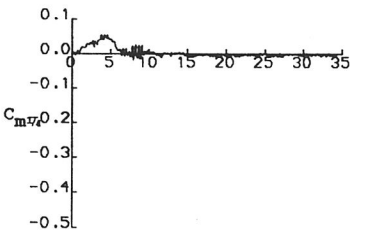


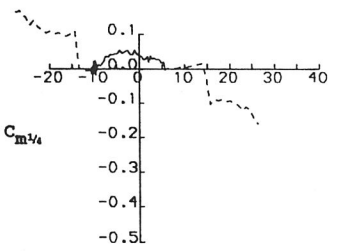


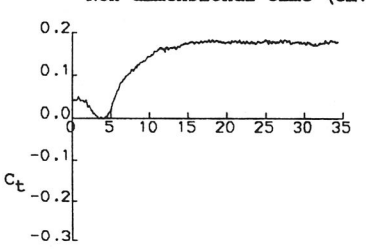


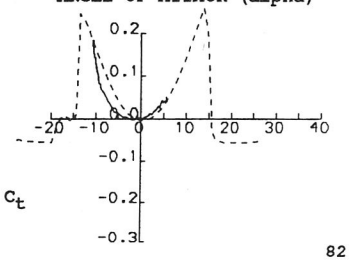








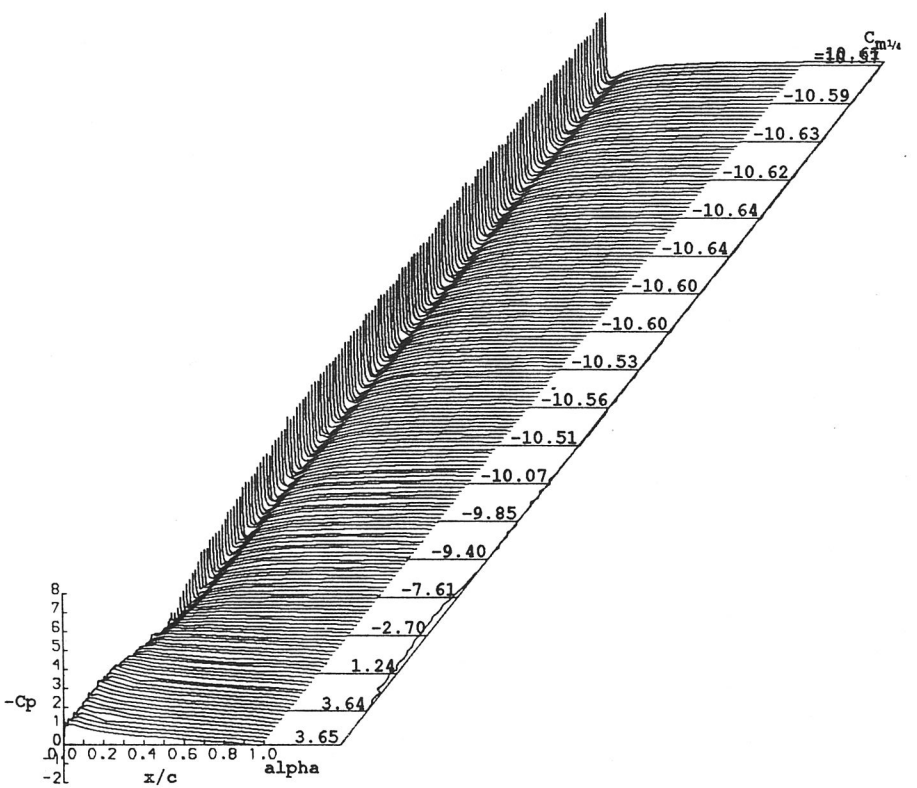


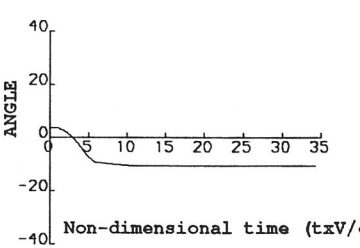


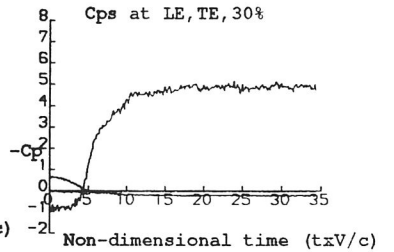
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

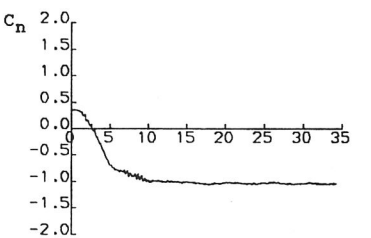
RUN REFERENCE NUMBER: 30831
REYNOLDS NUMBER = 1463241.
DYNAMIC PRESSURE = 985.28 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 4.00°
RAMP ARC = -14.000°
AVERAGED DATA OF 5 CYCLES

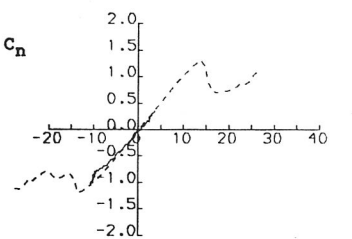
DATE OF TEST: 18/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 27.1°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02897
LINEAR PITCH RATE = $-246.26°S^{-1}$

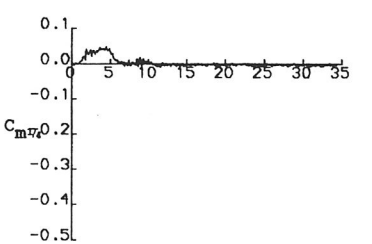


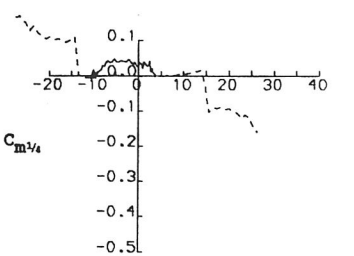


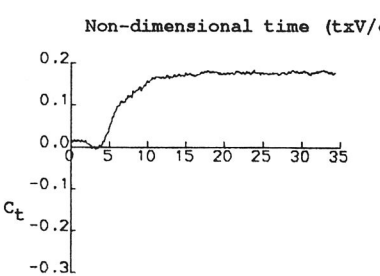


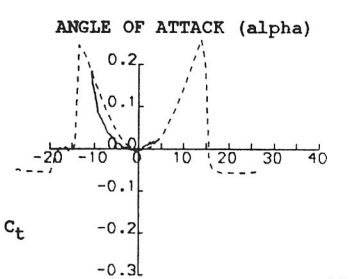








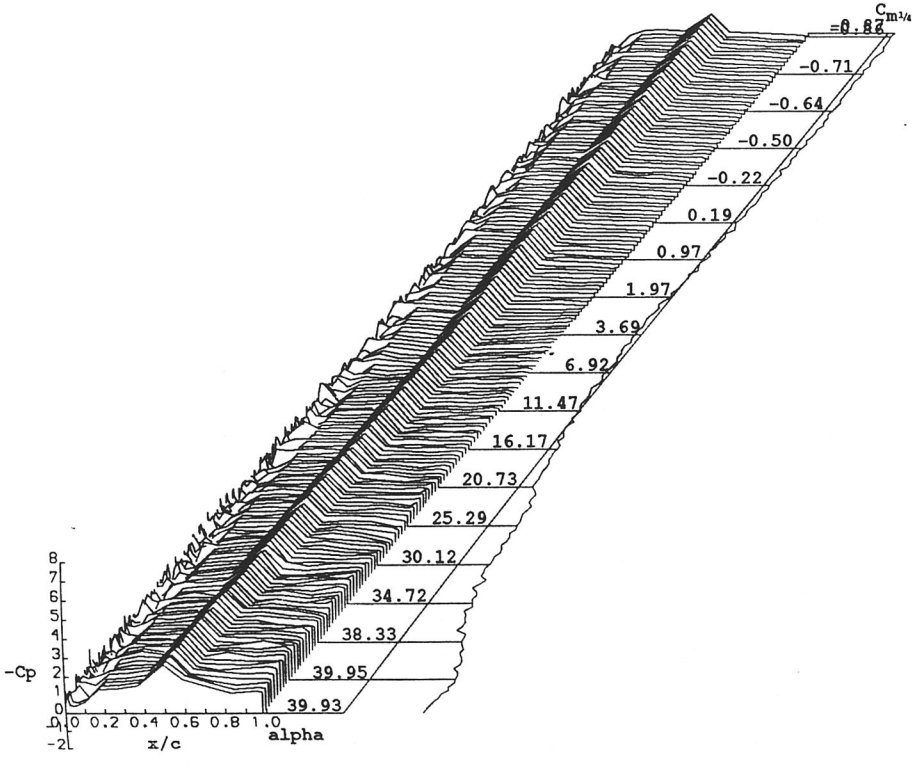


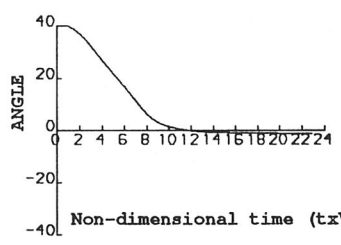


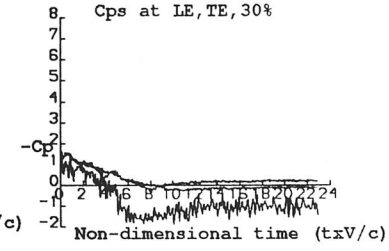
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

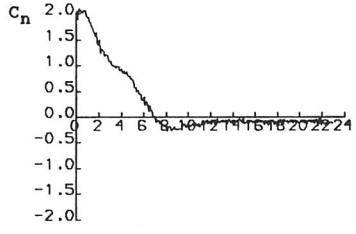
RUN REFERENCE NUMBER: 31871
REYNOLDS NUMBER = 1004290.
DYNAMIC PRESSURE = 448.81 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

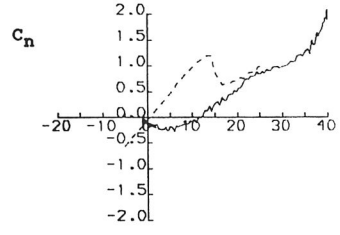
DATE OF TEST: 22/1/91
MACH NUMBER = 0.079
AIR TEMPERATURE = 25.1°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.04457
LINEAR PITCH RATE = $-252.74°S^{-1}$

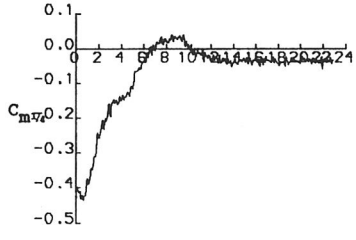


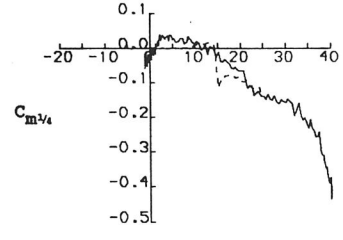


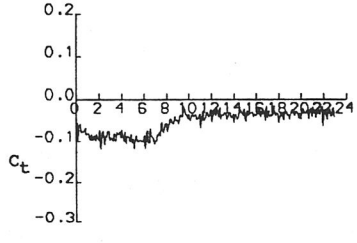


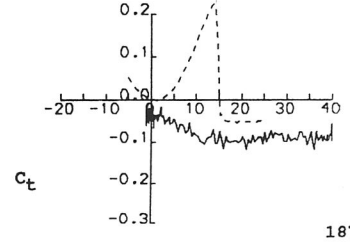








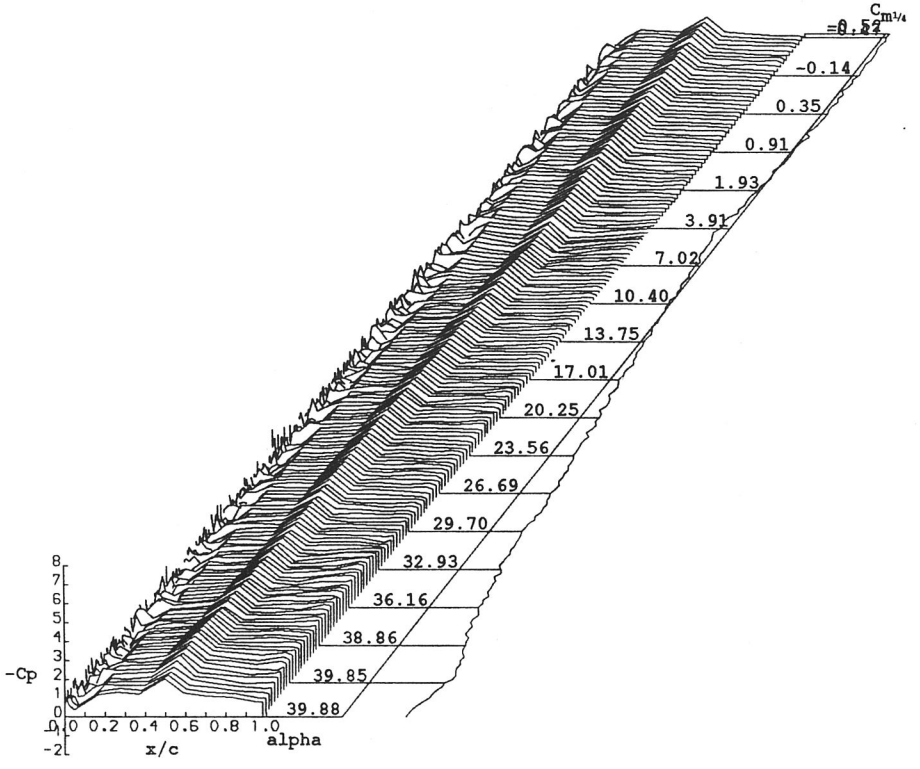


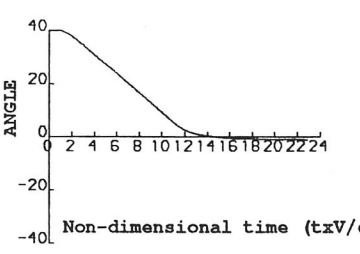


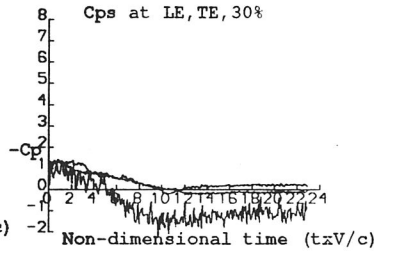
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

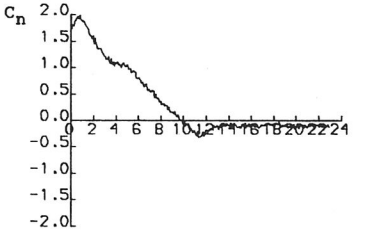
RUN REFERENCE NUMBER: 31881
REYNOLDS NUMBER = 1003859.
DYNAMIC PRESSURE = 448.81 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

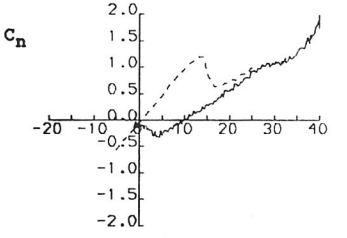
DATE OF TEST: 22/1/91
MACH NUMBER = 0.079
AIR TEMPERATURE = 25.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.03062
LINEAR PITCH RATE = $-173.70°S^{-1}$

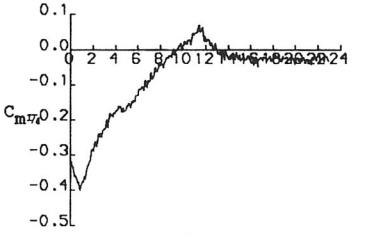


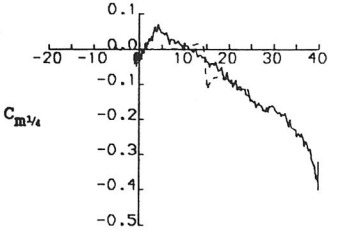






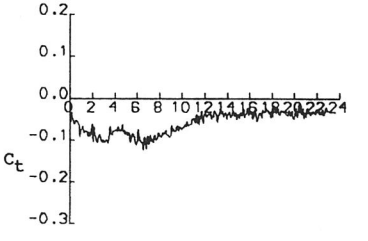


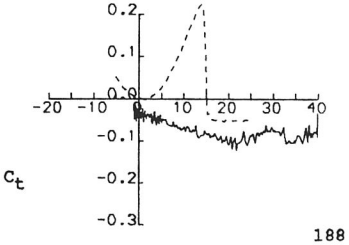




Non-dimensional time (txV/c)

ANGLE OF ATTACK (alpha)

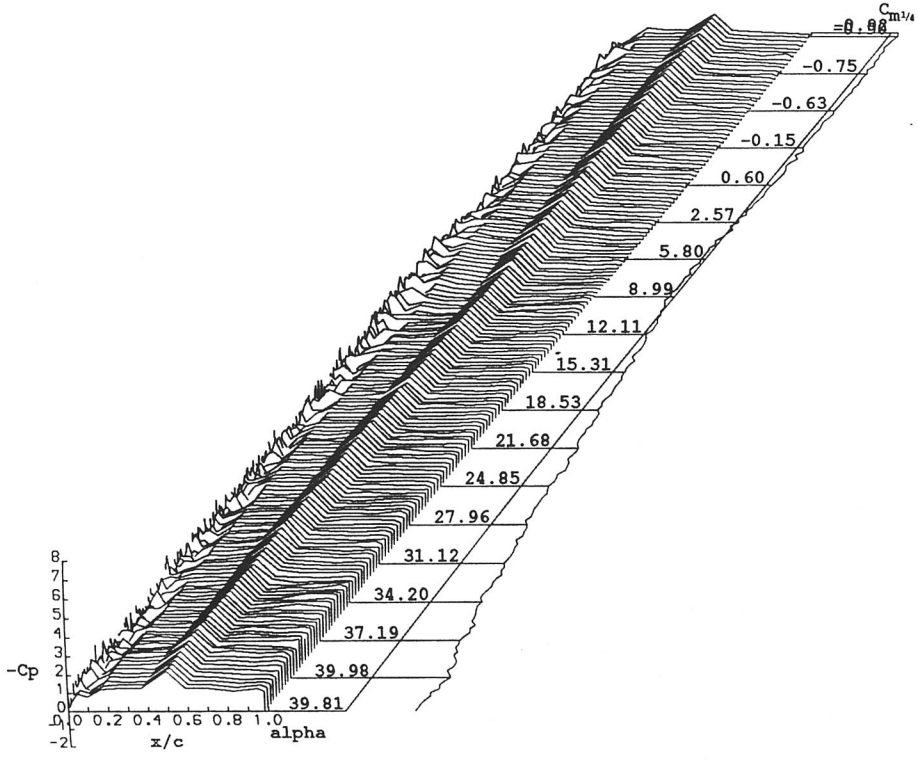


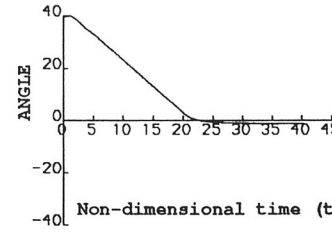


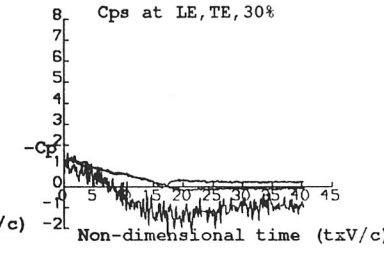
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

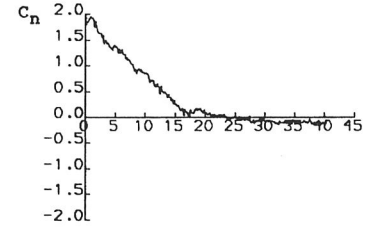
RUN REFERENCE NUMBER: 31891
REYNOLDS NUMBER = 1004290.
DYNAMIC PRESSURE = 448.81 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

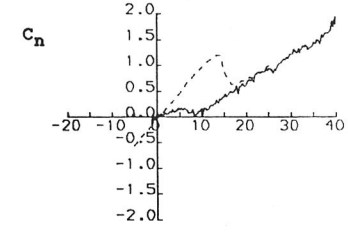
DATE OF TEST: 22/1/91
MACH NUMBER = 0.079
AIR TEMPERATURE = 25.1°C
SAMPLING FREQUENCY = 312.01 Hz.
REDUCED PITCH RATE = -0.01705
LINEAR PITCH RATE = $-96.72°S^{-1}$

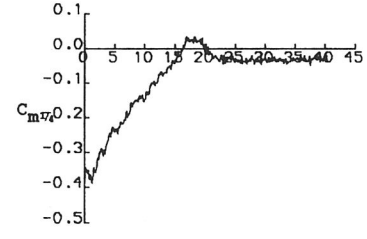


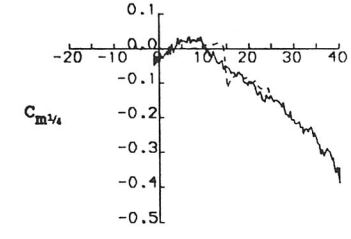


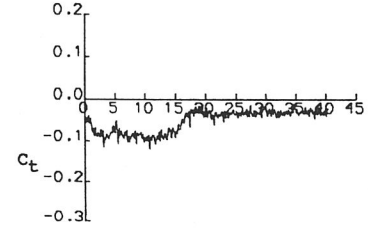


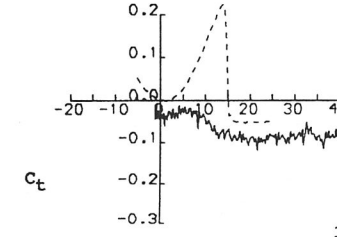








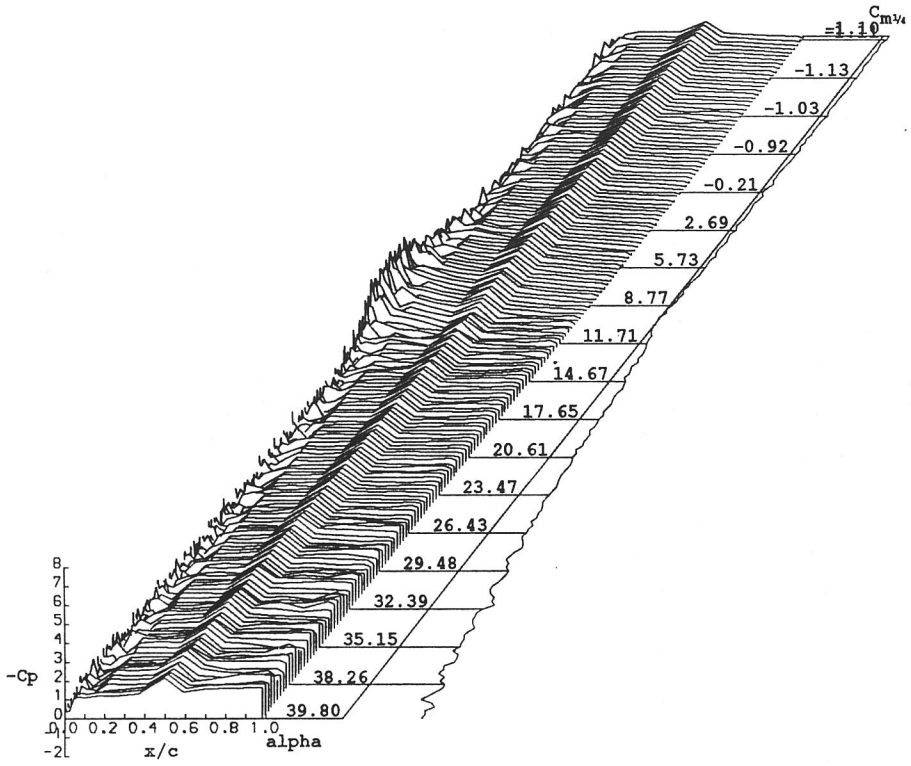


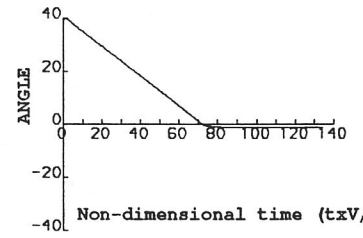


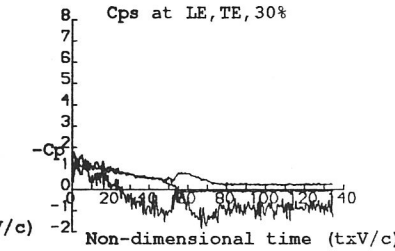
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

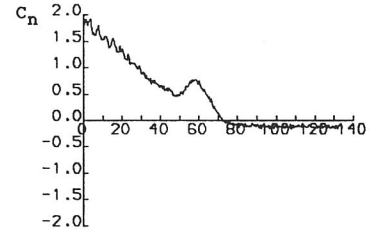
RUN REFERENCE NUMBER: 31901
REYNOLDS NUMBER = 1003859.
DYNAMIC PRESSURE = 448.81 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

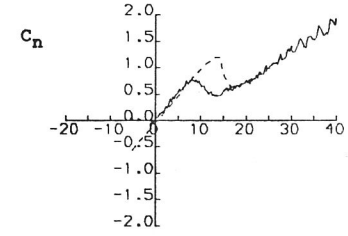
DATE OF TEST: 22/1/91
MACH NUMBER = 0.079
AIR TEMPERATURE = 25.2°C
SAMPLING FREQUENCY = 93.70 Hz.
REDUCED PITCH RATE = -0.00484
LINEAR PITCH RATE = $-27.46°S^{-1}$

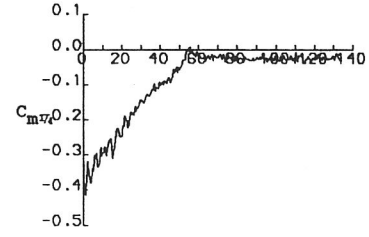


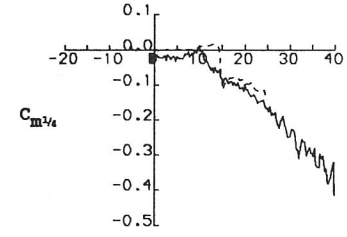


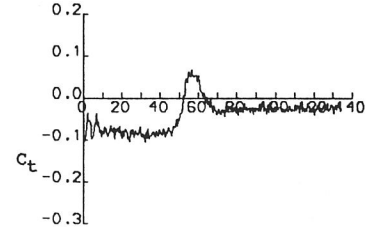


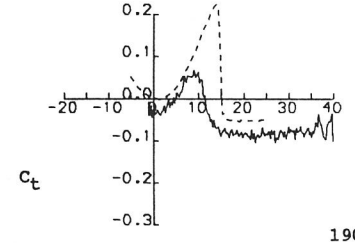








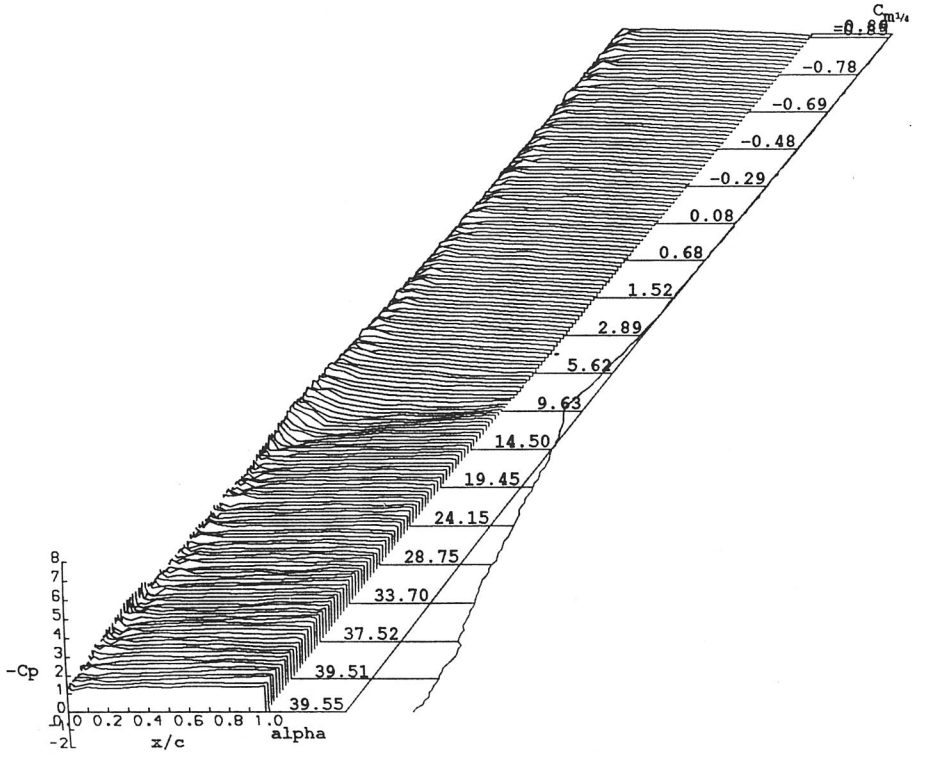


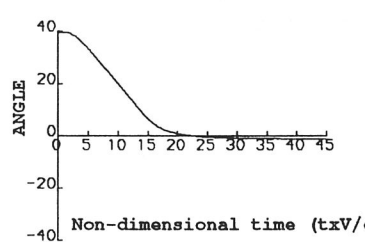


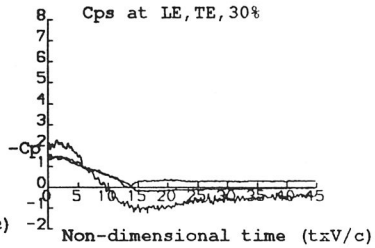
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

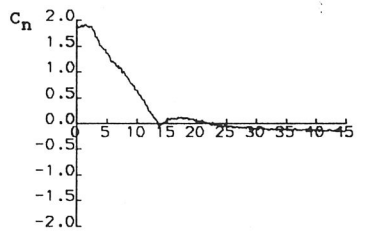
RUN REFERENCE NUMBER: 31911
REYNOLDS NUMBER = 1968547.
DYNAMIC PRESSURE = 1724.38 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

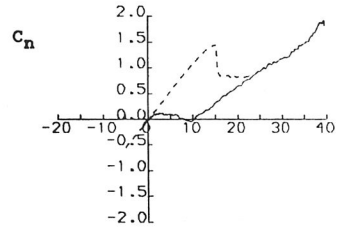
DATE OF TEST: 22/1/91
MACH NUMBER = 0.154
AIR TEMPERATURE = 25.1°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.02322
LINEAR PITCH RATE = -258.06°S^{-1}

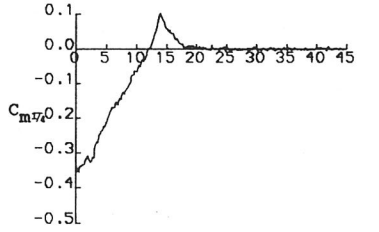


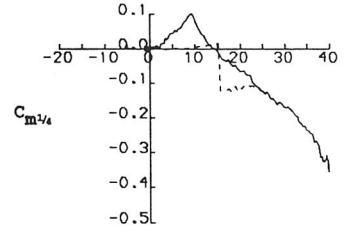


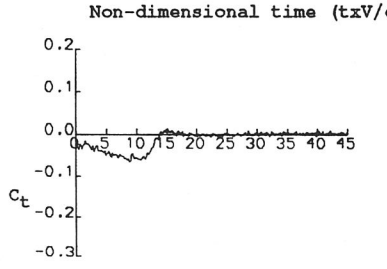


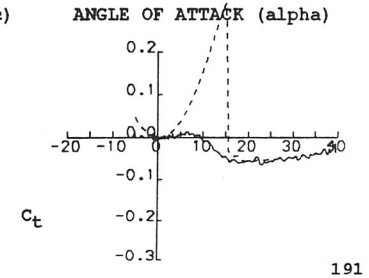








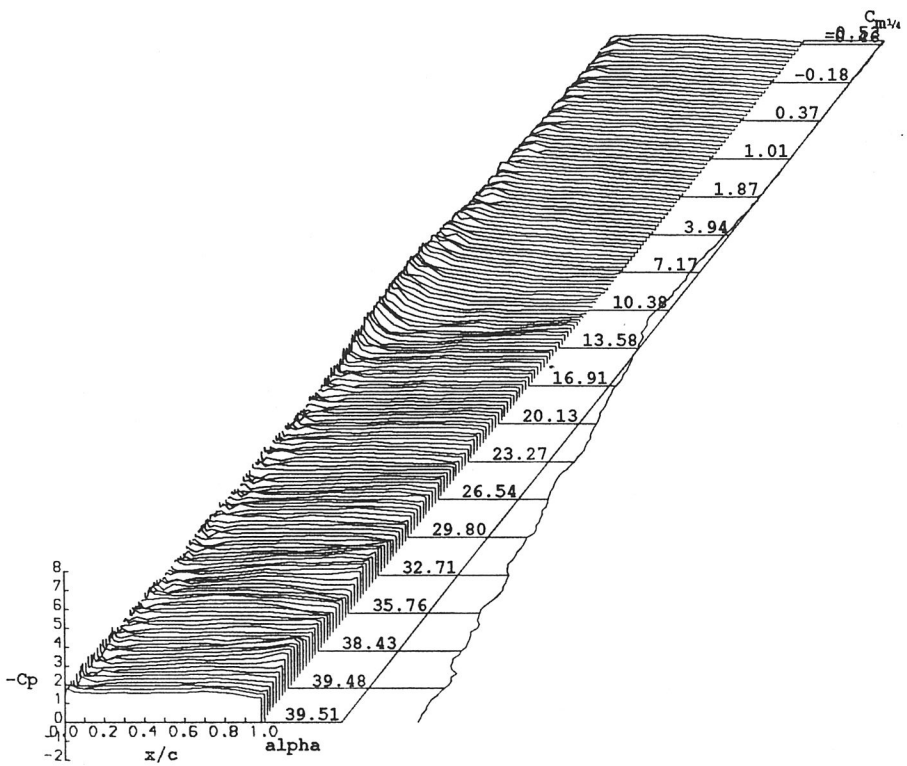


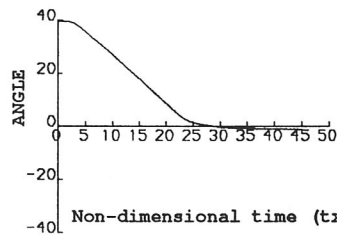


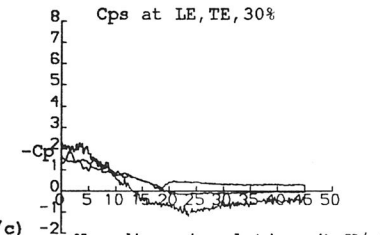
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

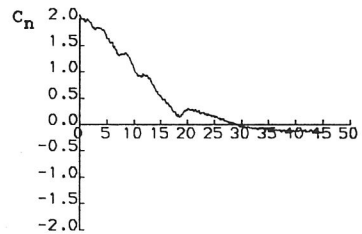
RUN REFERENCE NUMBER: 31921
REYNOLDS NUMBER = 1945127.
DYNAMIC PRESSURE = 1724.38 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

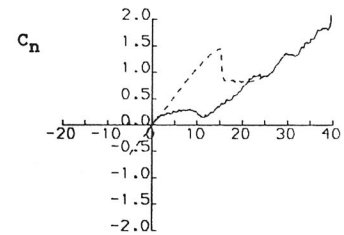
DATE OF TEST: 22/1/91
MACH NUMBER = 0.154
AIR TEMPERATURE = 27.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = -0.01595
LINEAR PITCH RATE = $-178.10°S^{-1}$

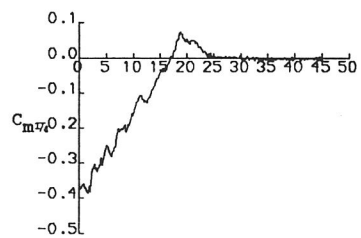


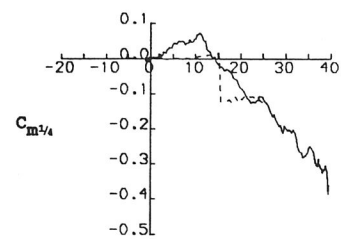


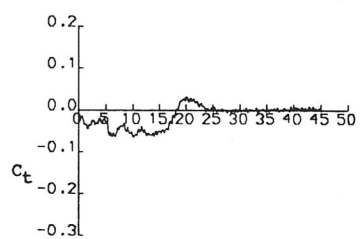


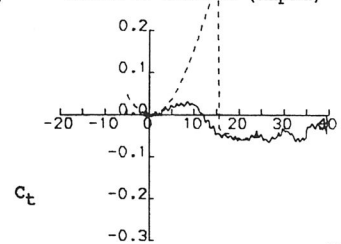








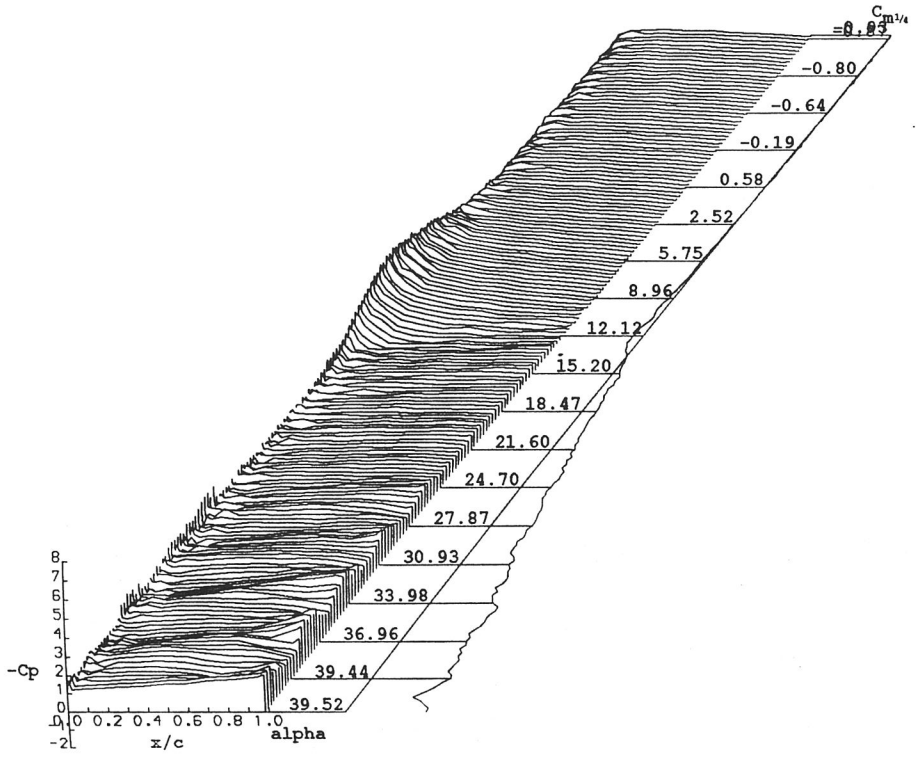


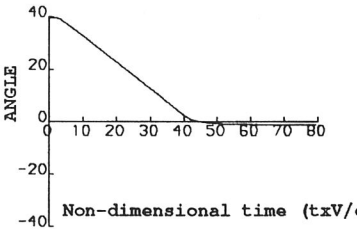


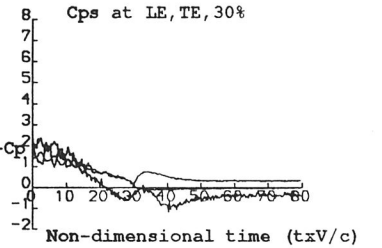
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

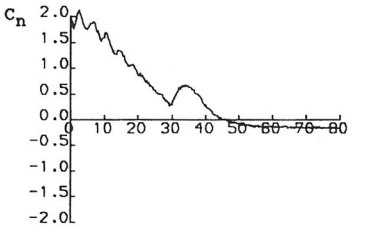
RUN REFERENCE NUMBER: 31931
REYNOLDS NUMBER = 1936891.
DYNAMIC PRESSURE = 1724.38 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

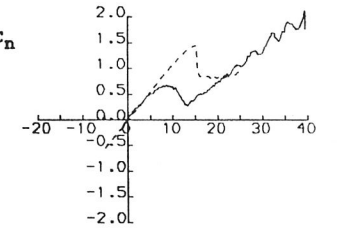
DATE OF TEST: 22/1/91
MACH NUMBER = 0.154
AIR TEMPERATURE = 28.9°C
SAMPLING FREQUENCY = 312.01 Hz.
REDUCED PITCH RATE = -0.00861
LINEAR PITCH RATE = -96.31°S^{-1}

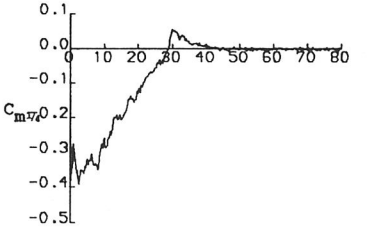


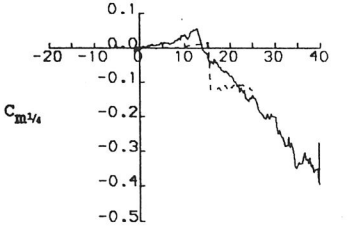


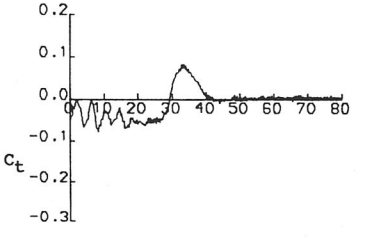


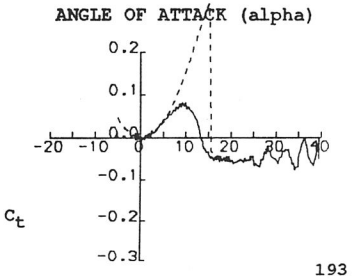








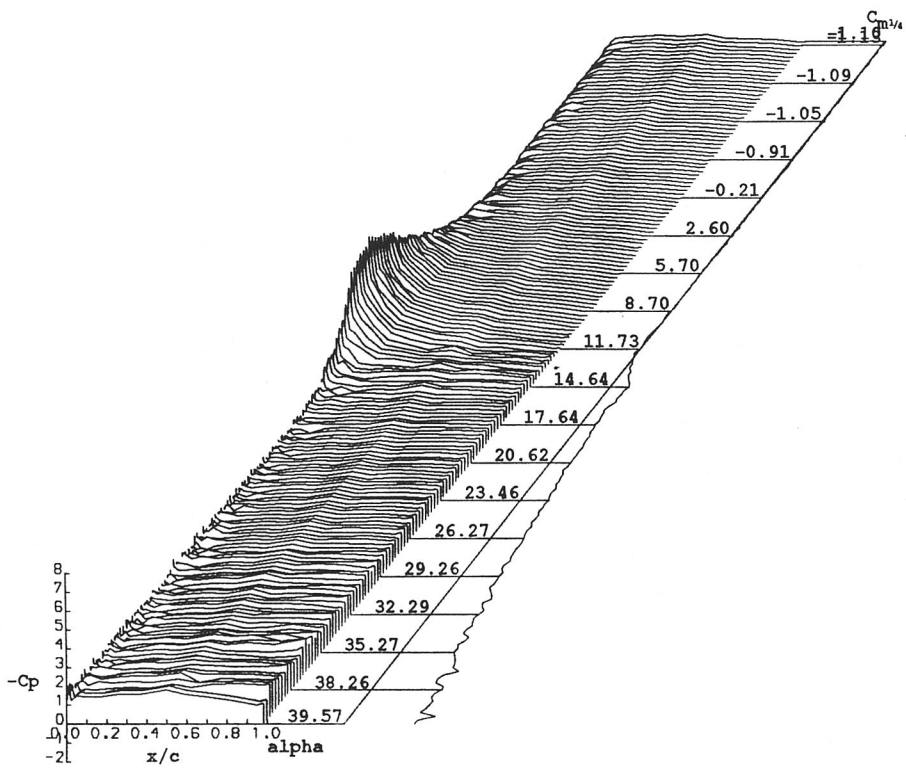


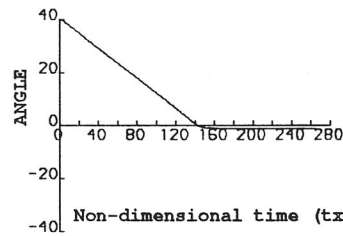


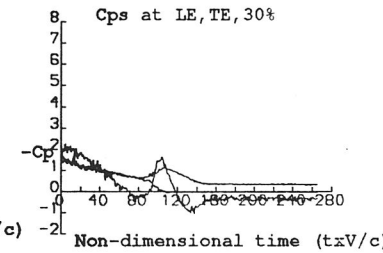
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

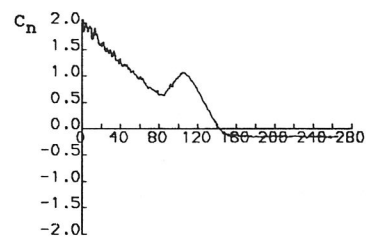
RUN REFERENCE NUMBER: 31941
REYNOLDS NUMBER = 1928721.
DYNAMIC PRESSURE = 1724.38 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = 40.00°
RAMP ARC = -41.000°
AVERAGED DATA OF 5 CYCLES

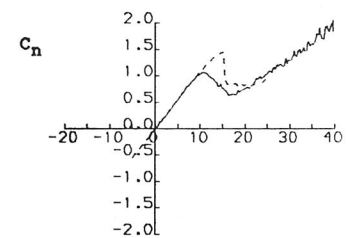
DATE OF TEST: 22/1/91
MACH NUMBER = 0.154
AIR TEMPERATURE = 29.9°C
SAMPLING FREQUENCY = 93.70 Hz.
REDUCED PITCH RATE = -0.00246
LINEAR PITCH RATE = $-27.59°S^{-1}$

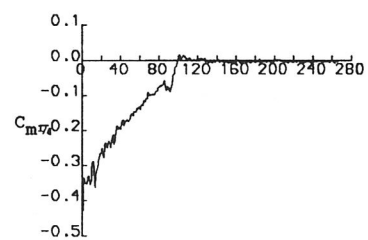


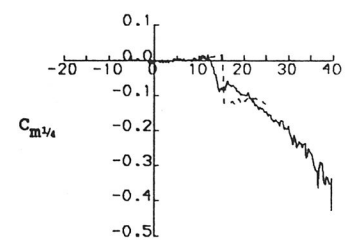


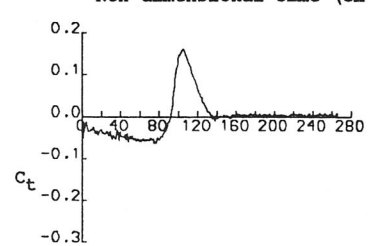


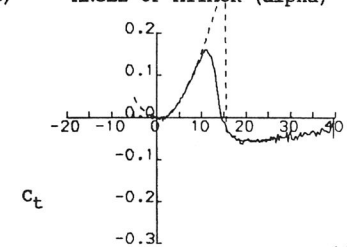








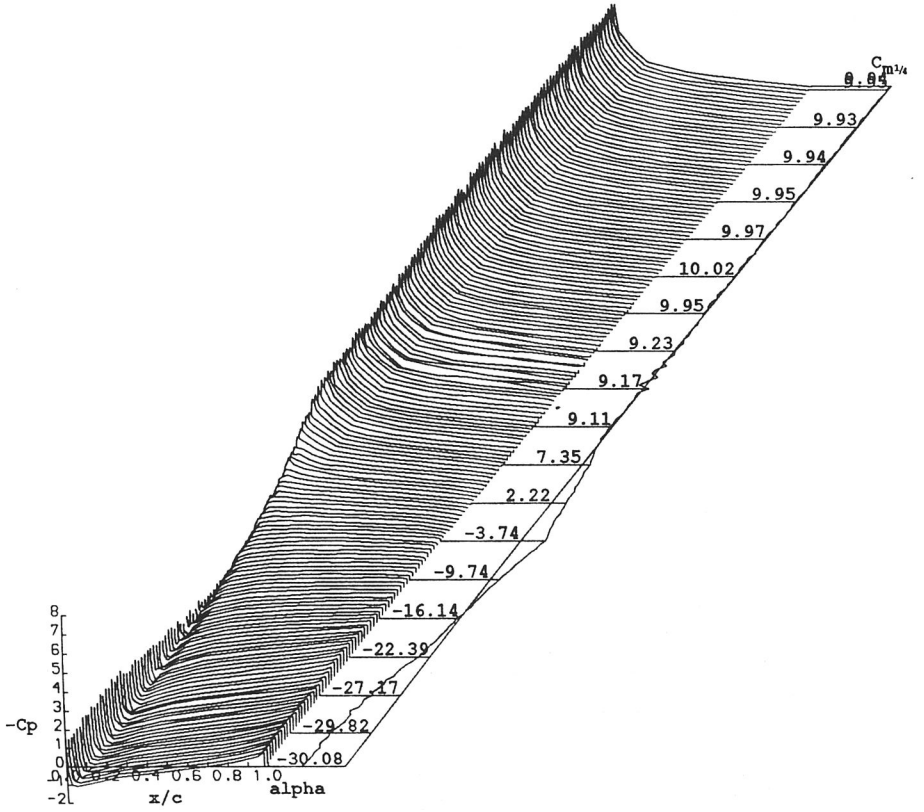


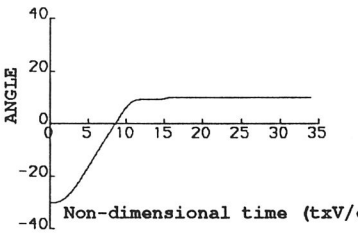


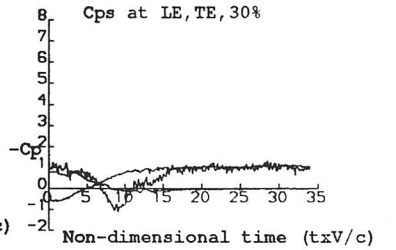
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

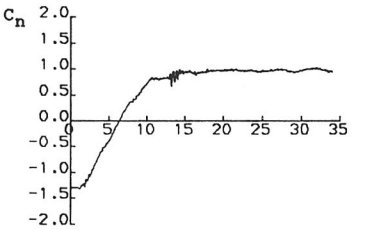
RUN REFERENCE NUMBER: 630871
REYNOLDS NUMBER = 1492850.
DYNAMIC PRESSURE = 983.89 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -30.00°
RAMP ARC = 40.000°
AVERAGED DATA OF 5 CYCLES

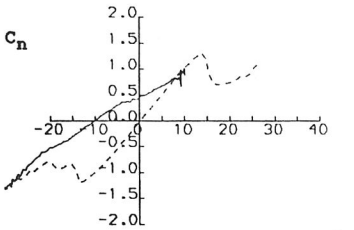
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 22.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.04189
LINEAR PITCH RATE = 352.78°S^{-1}





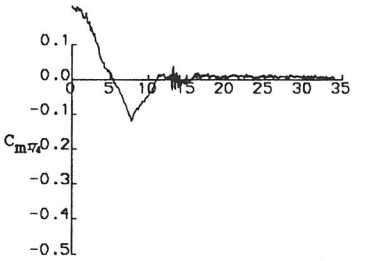


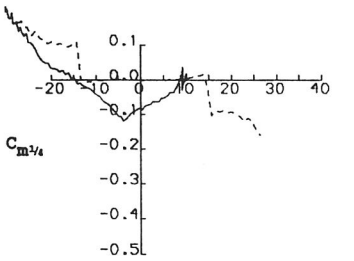




Non-dimensional time (txV/c)

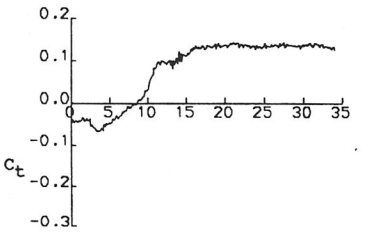
ANGLE OF ATTACK (alpha)

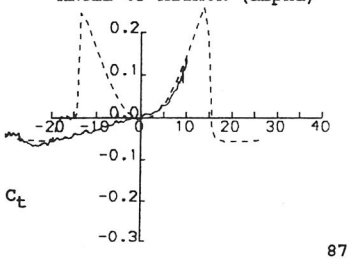




Non-dimensional time (txV/c)

ANGLE OF ATTACK (alpha)

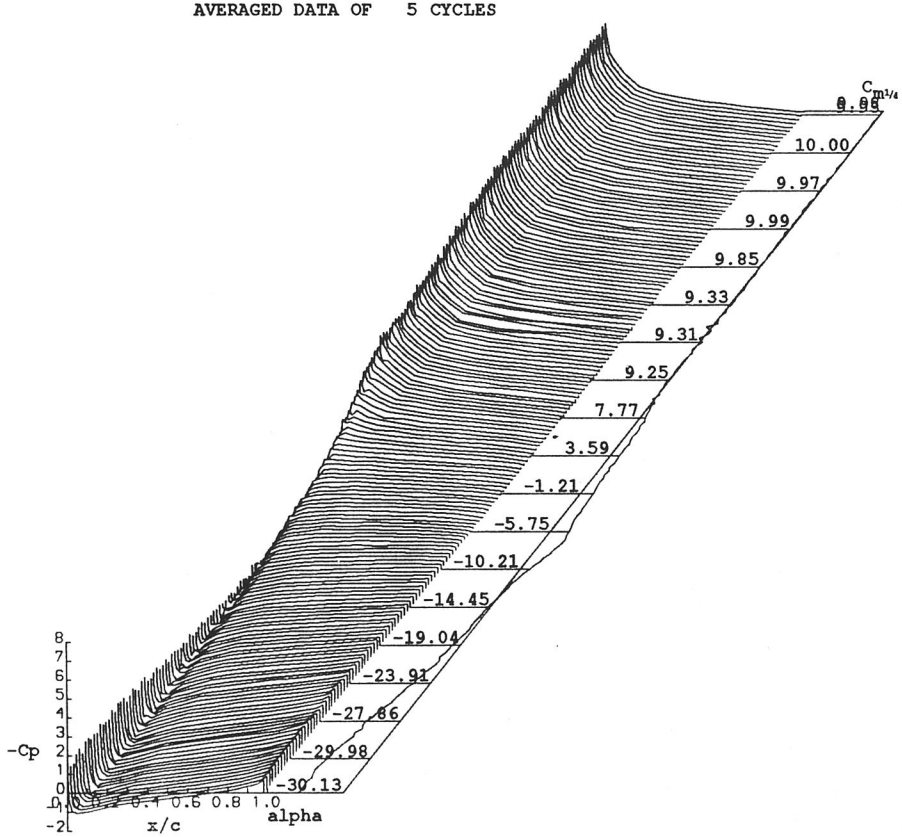


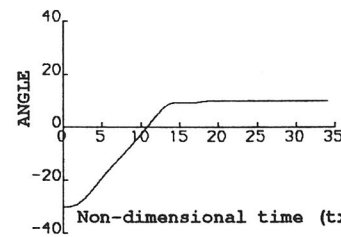


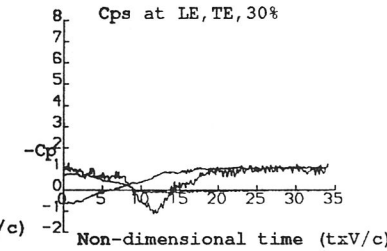
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

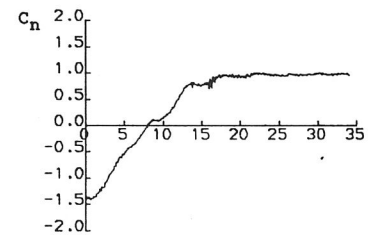
RUN REFERENCE NUMBER: 630881
REYNOLDS NUMBER = 1488971.
DYNAMIC PRESSURE = 983.89 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -30.00°
RAMP ARC = 40.000°
AVERAGED DATA OF 5 CYCLES

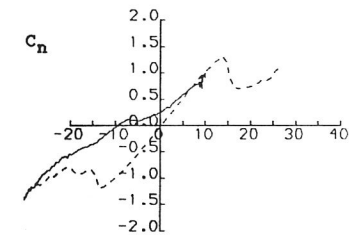
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 23.1°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02867
LINEAR PITCH RATE = 241.67°S^{-1}

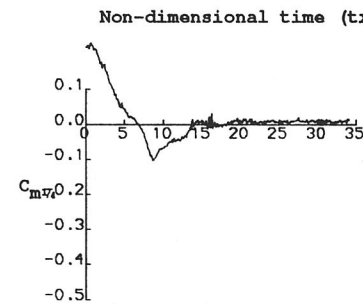


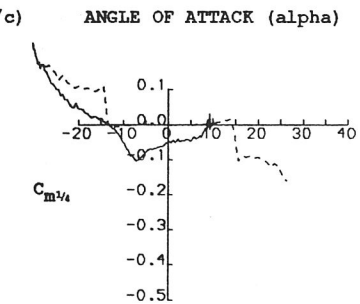


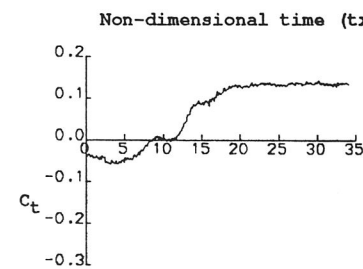


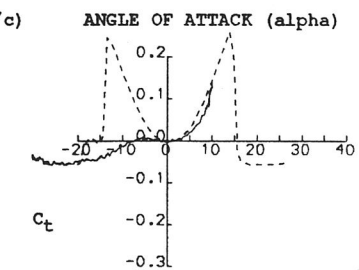








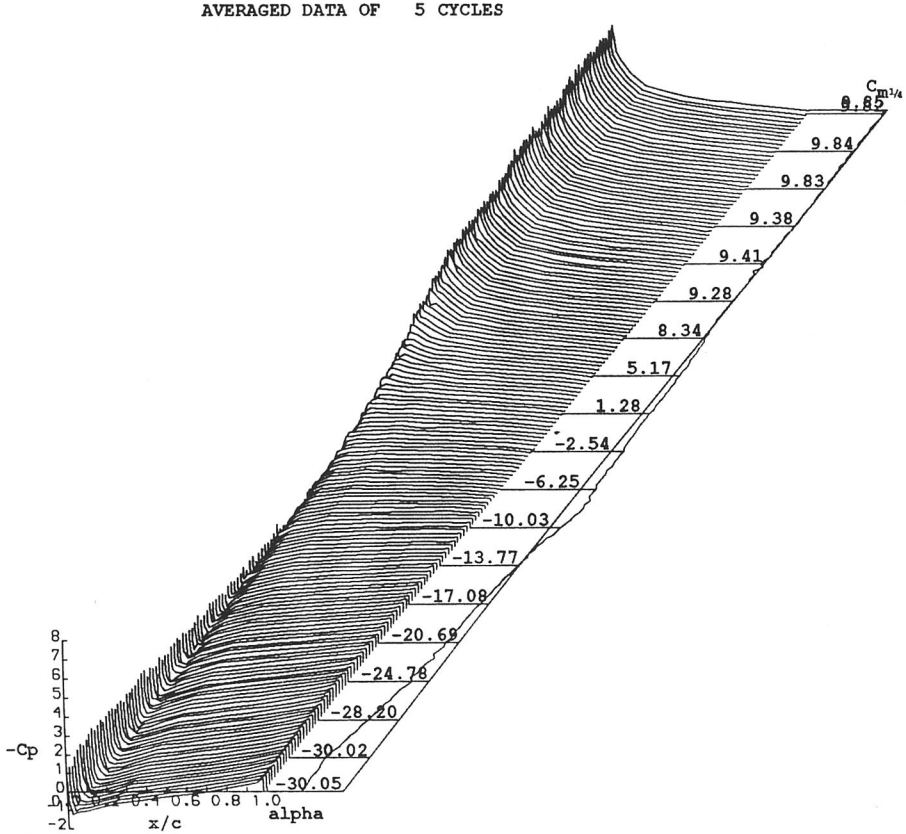


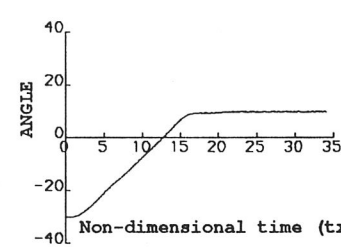


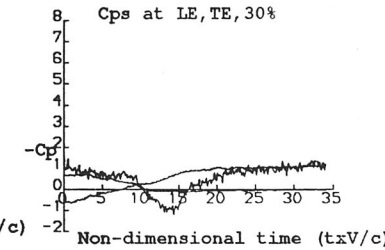
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

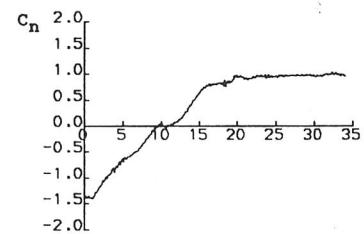
RUN REFERENCE NUMBER: 630891
REYNOLDS NUMBER = 1486396.
DYNAMIC PRESSURE = 983.89 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -30.00°
RAMP ARC = 40.000°
AVERAGED DATA OF 5 CYCLES

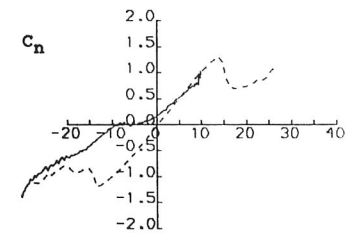
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 23.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02296
LINEAR PITCH RATE = 193.70°S^{-1}





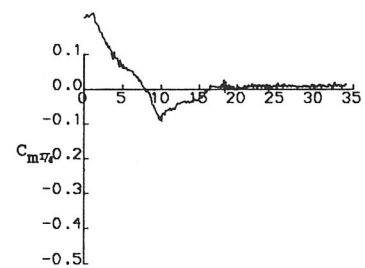


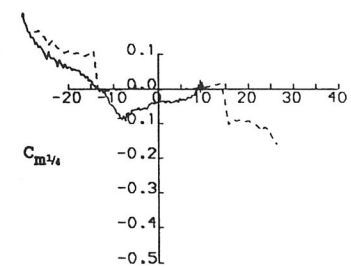




Non-dimensional time (txV/c)

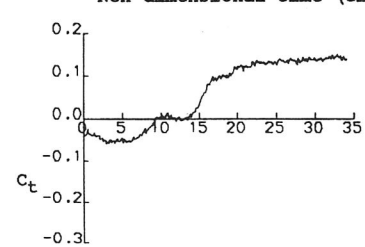
ANGLE OF ATTACK (alpha)

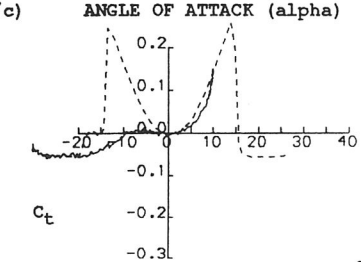




Non-dimensional time (txV/c)

ANGLE OF ATTACK (alpha)

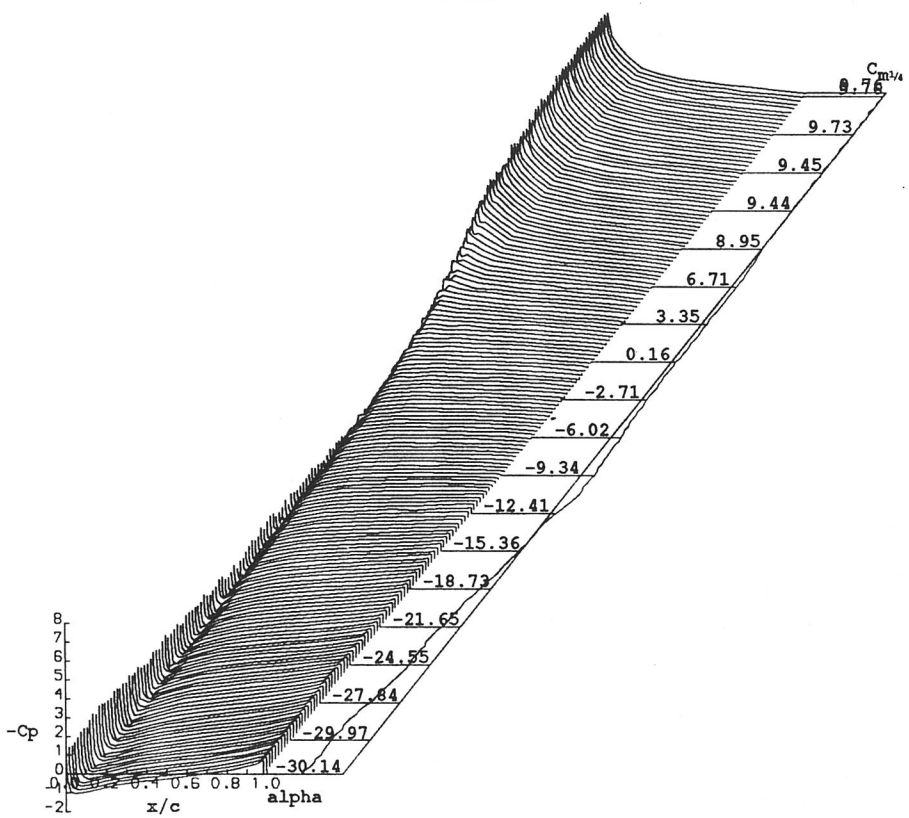


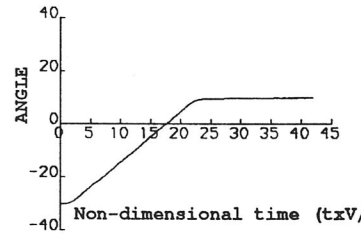


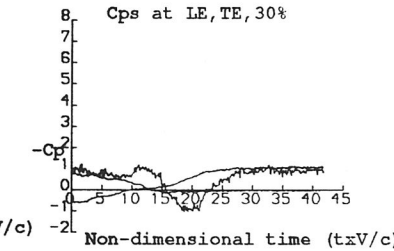
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

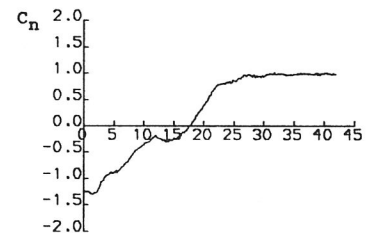
RUN REFERENCE NUMBER: 630901
REYNOLDS NUMBER = 1494687.
DYNAMIC PRESSURE = 994.89 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -30.00°
RAMP ARC = 40.000°
AVERAGED DATA OF 5 CYCLES

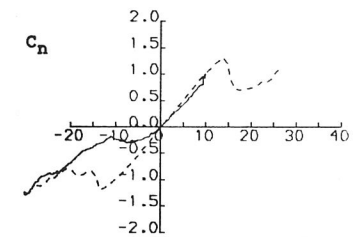
DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 23.5°C
SAMPLING FREQUENCY = 450.05 Hz.
REDUCED PITCH RATE = 0.01676
LINEAR PITCH RATE = 142.13°S^{-1}

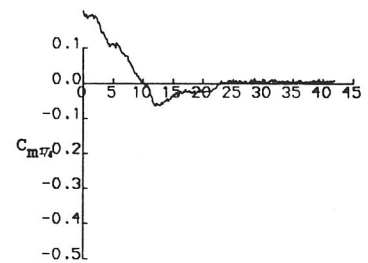


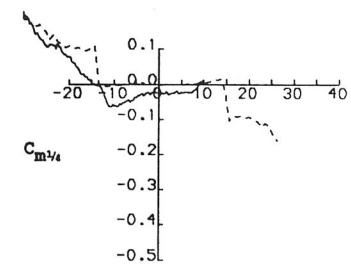


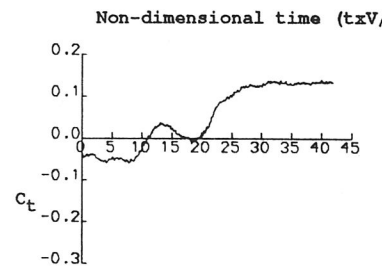


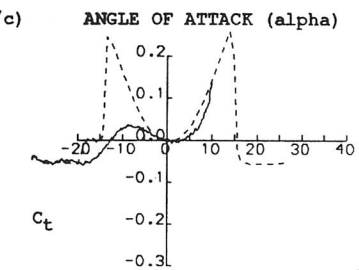






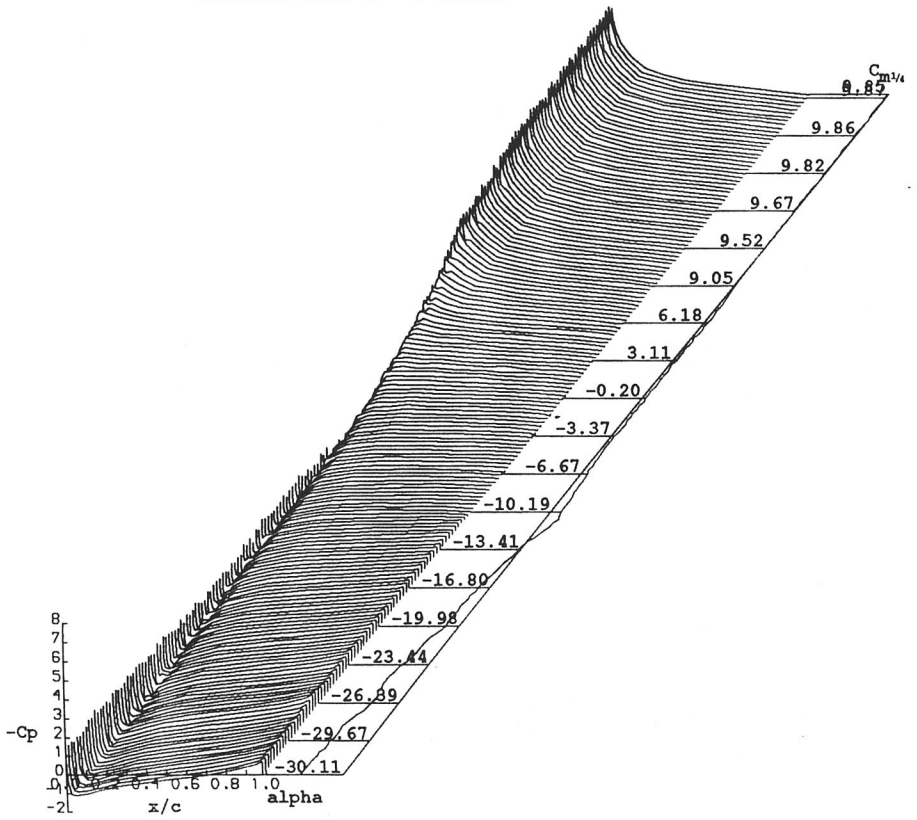


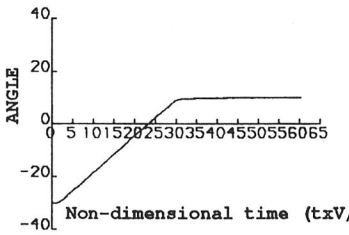


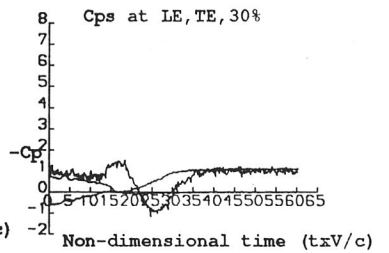


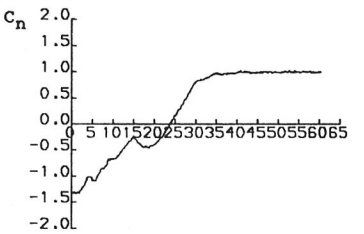
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

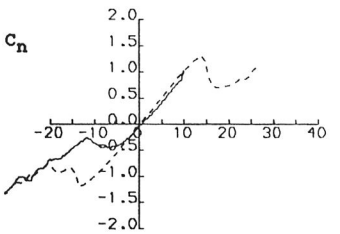
RUN REFERENCE NUMBER: 630911
DATE OF TEST: 19/12/90
REYNOLDS NUMBER = 1490175.
MACH NUMBER = 0.118
DYNAMIC PRESSURE = 994.89 Nm^{-2}
AIR TEMPERATURE = 24.2°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 312.01 Hz.
MOTION TYPE: RAMP DOWN
REDUCED PITCH RATE = 0.01180
START ANGLE = -30.00°
LINEAR PITCH RATE = 100.21°S^{-1}
RAMP ARC = 40.000°
AVERAGED DATA OF 5 CYCLES

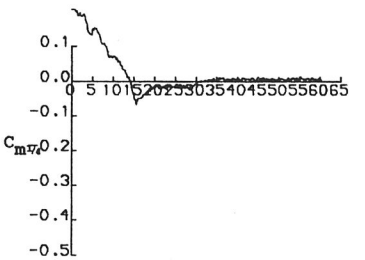


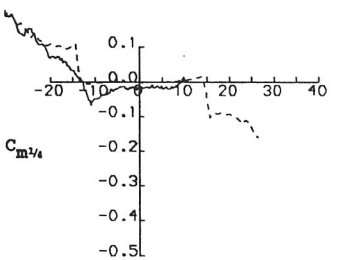


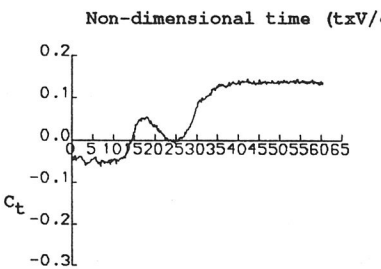


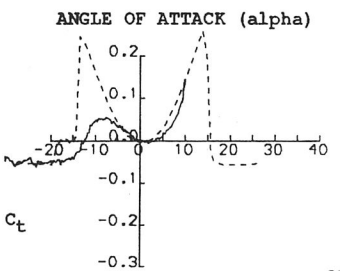








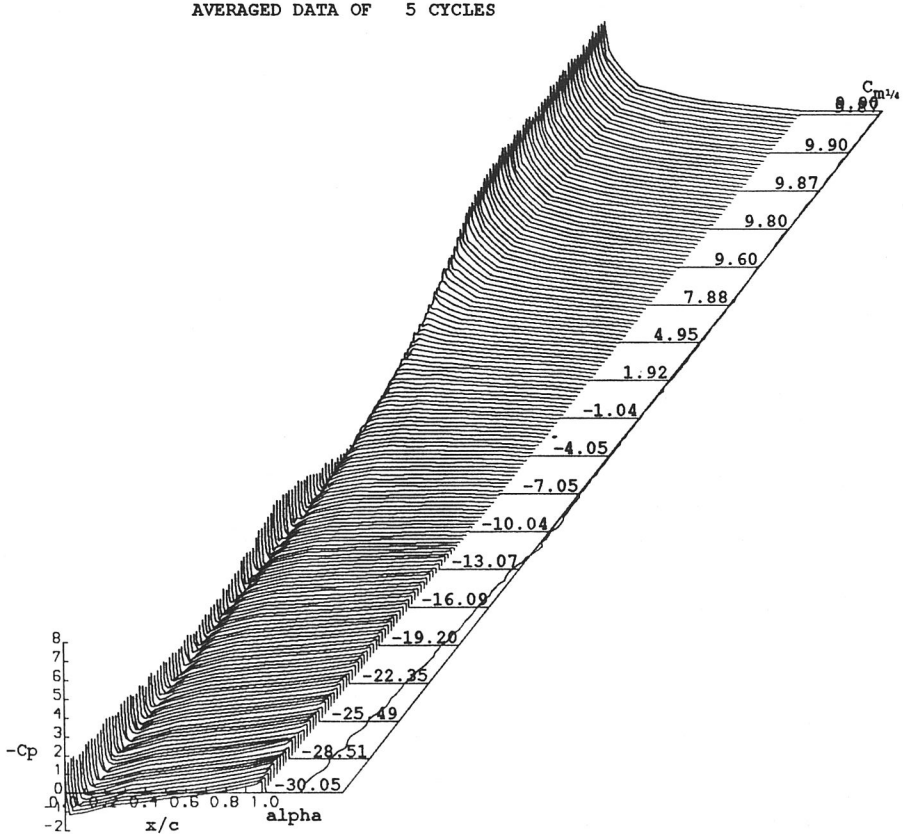


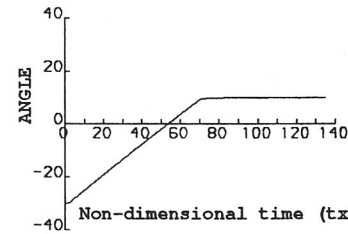


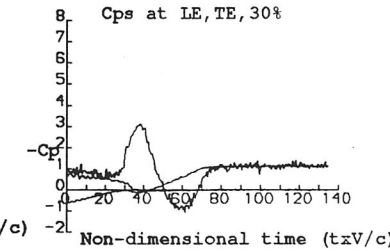
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

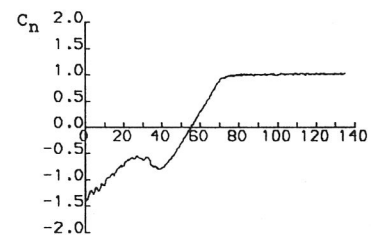
RUN REFERENCE NUMBER: 630921
REYNOLDS NUMBER = 1487609.
DYNAMIC PRESSURE = 994.89 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -30.00°
RAMP ARC = 40.000°
AVERAGED DATA OF 5 CYCLES

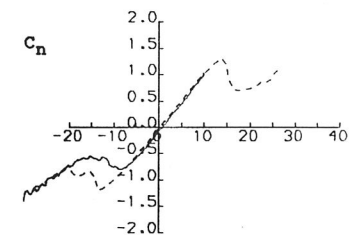
DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 24.6°C
SAMPLING FREQUENCY = 140.00 Hz.
REDUCED PITCH RATE = 0.00503
LINEAR PITCH RATE = 42.74°S^{-1}



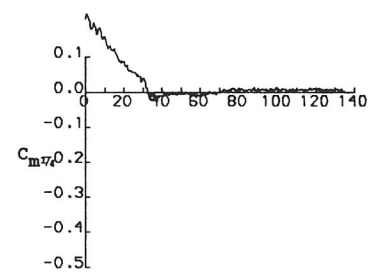




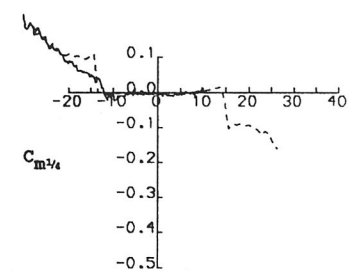




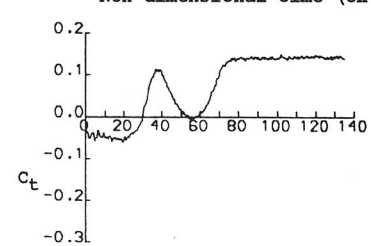
Non-dimensional time (txV/c)



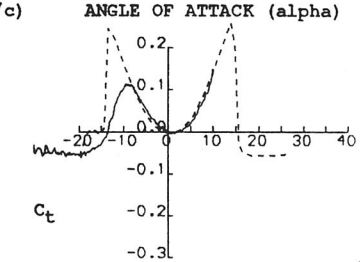
ANGLE OF ATTACK (alpha)



Non-dimensional time (txV/c)



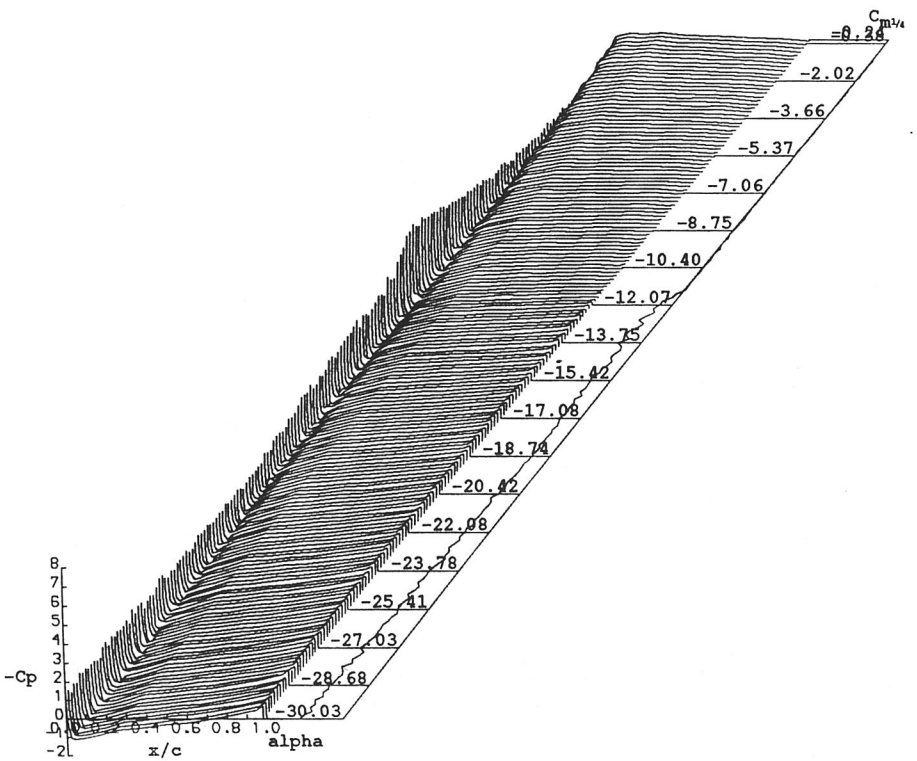
ANGLE OF ATTACK (alpha)

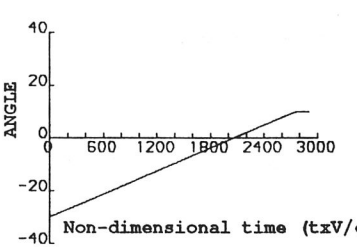


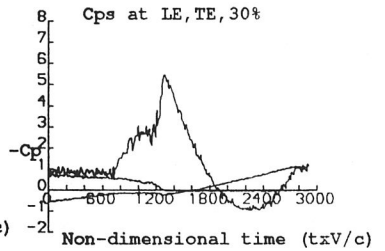
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

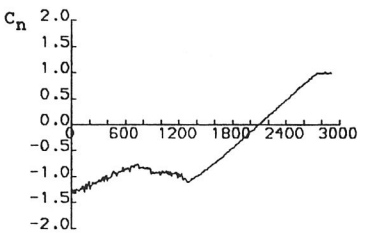
RUN REFERENCE NUMBER: 630931
REYNOLDS NUMBER = 1483138.
DYNAMIC PRESSURE = 994.89 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -30.00°
RAMP ARC = 40.000°
AVERAGED DATA OF 5 CYCLES

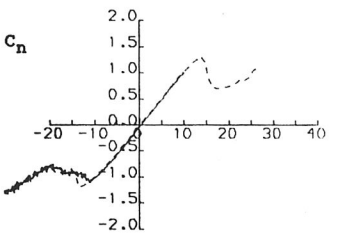
DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 25.3°C
SAMPLING FREQUENCY = 6.50 Hz.
REDUCED PITCH RATE = 0.00013
LINEAR PITCH RATE = 1.09°S^{-1}

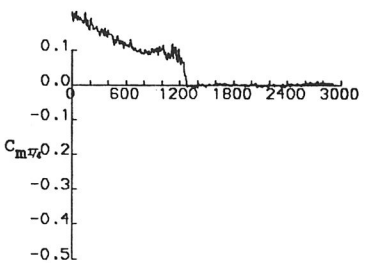


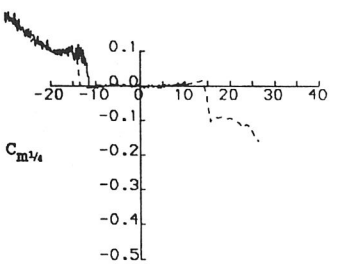


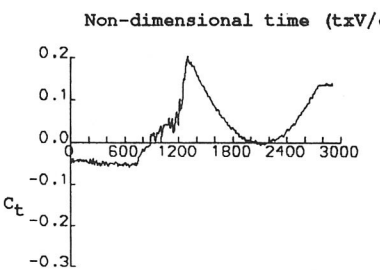


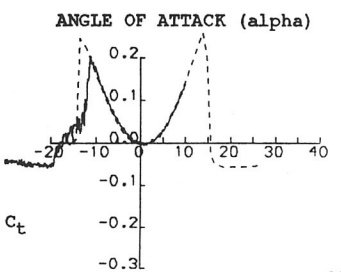








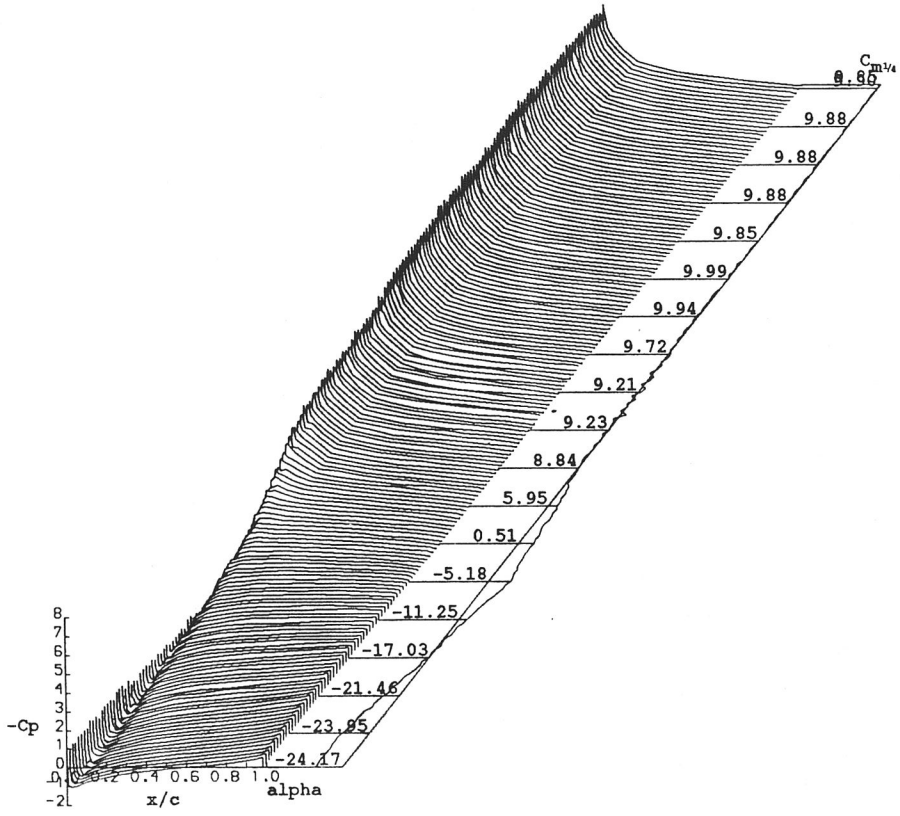


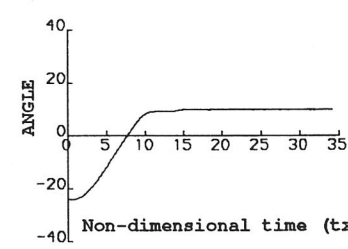


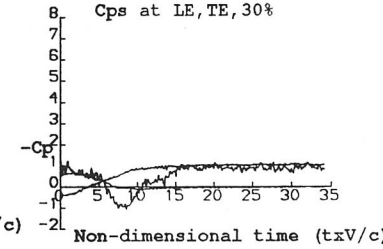
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

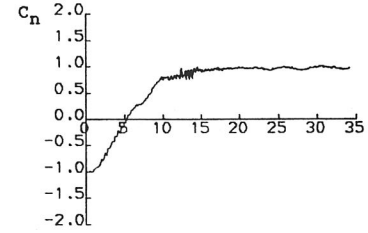
RUN REFERENCE NUMBER: 630941
REYNOLDS NUMBER = 1471058.
DYNAMIC PRESSURE = 982.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -24.00°
RAMP ARC = 34.000°
AVERAGED DATA OF 5 CYCLES

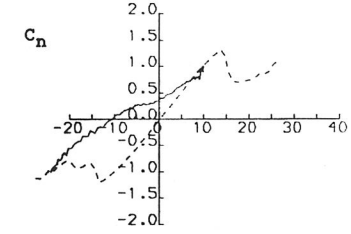
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 25.7°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03852
LINEAR PITCH RATE = 325.83°S^{-1}

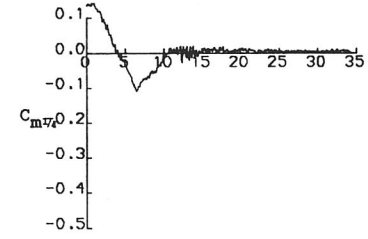


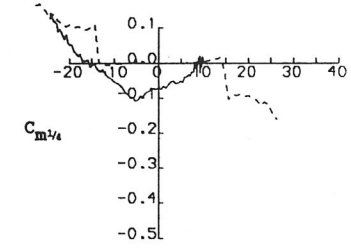


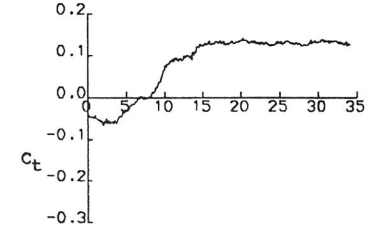


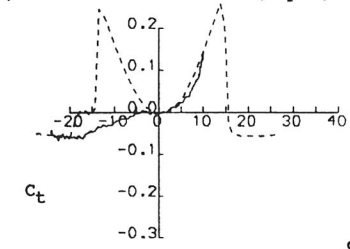






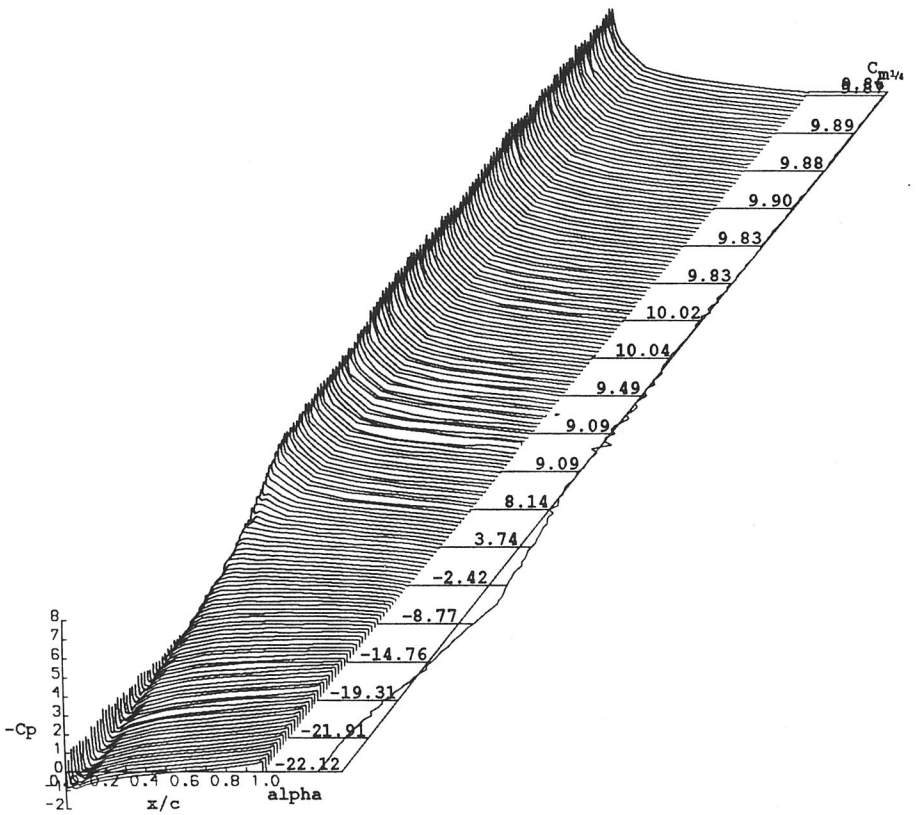


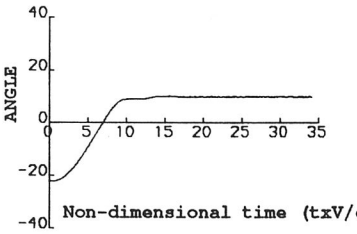


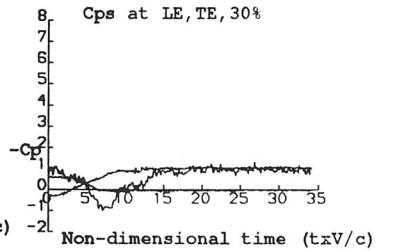


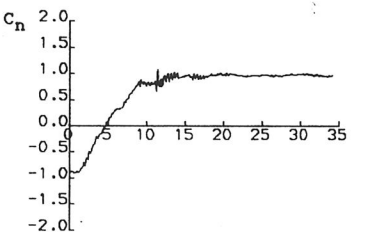
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

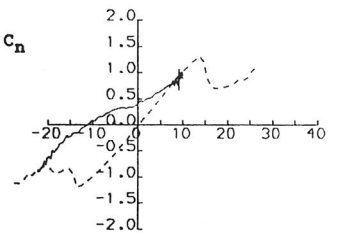
RUN REFERENCE NUMBER: 630951
DATE OF TEST: 19/12/90
REYNOLDS NUMBER = 1469798.
MACH NUMBER = 0.117
DYNAMIC PRESSURE = 982.12 Nm^{-2}
AIR TEMPERATURE = 25.9°C
NUMBER OF CYCLES = 5
SAMPLING FREQUENCY = 550.05 Hz.
MOTION TYPE: RAMP DOWN
REDUCED PITCH RATE = 0.04076
START ANGLE = -22.00°
LINEAR PITCH RATE = 344.92°S^{-1}
RAMP ARC = 32.000°
AVERAGED DATA OF 5 CYCLES

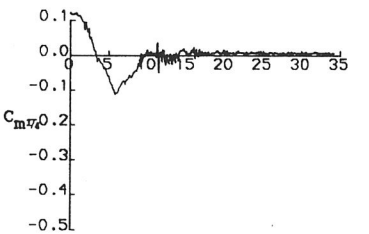


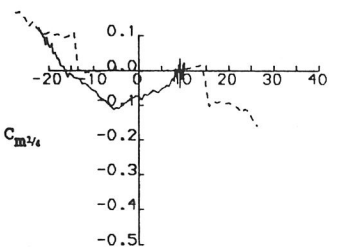


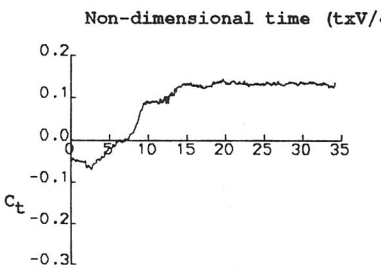


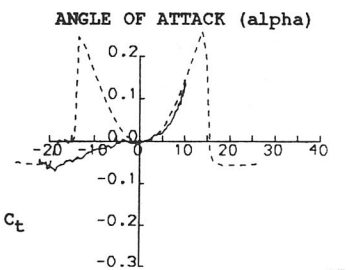








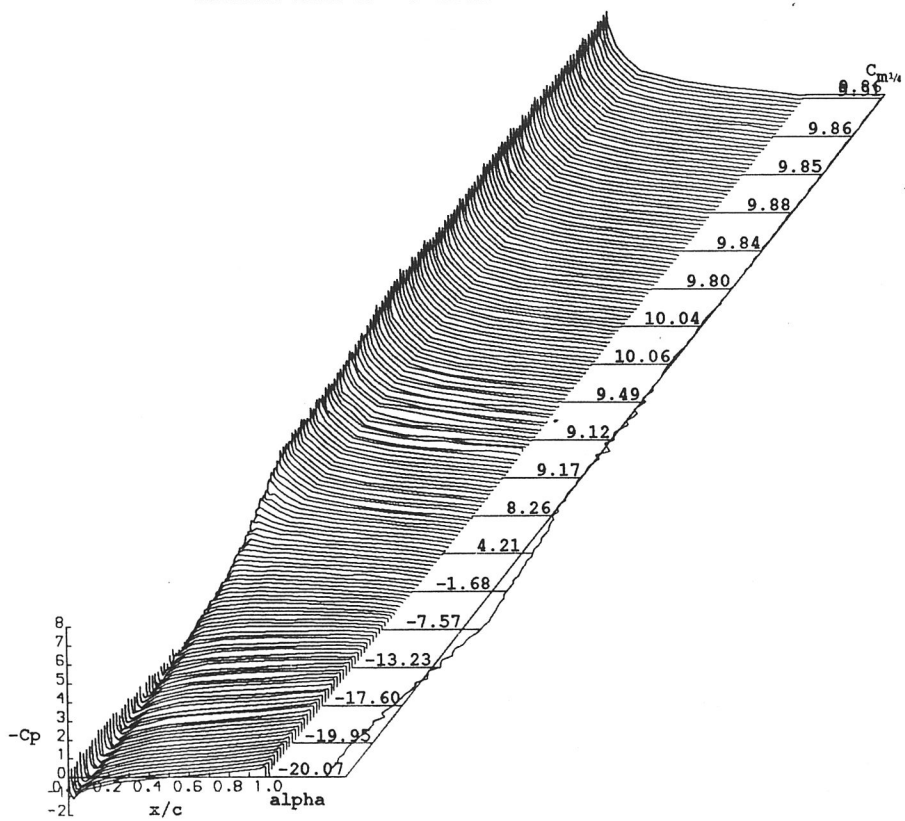


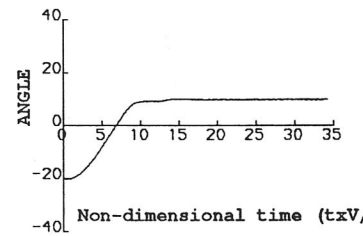


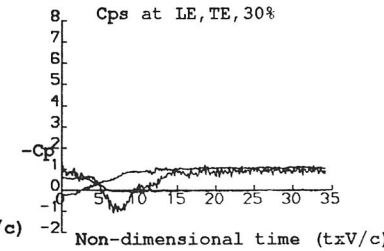
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

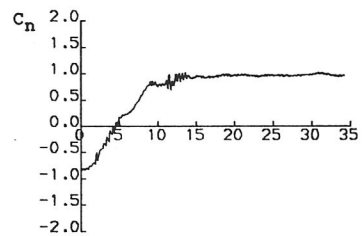
RUN REFERENCE NUMBER: 630961
REYNOLDS NUMBER = 1466656.
DYNAMIC PRESSURE = 982.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -20.00°
RAMP ARC = 30.000°
AVERAGED DATA OF 5 CYCLES

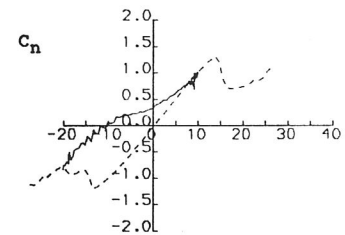
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.4°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03835
LINEAR PITCH RATE = 324.75°S^{-1}

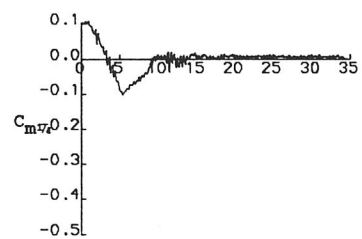


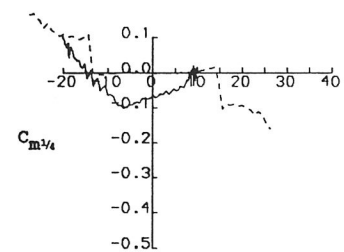


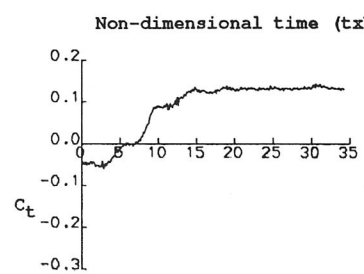


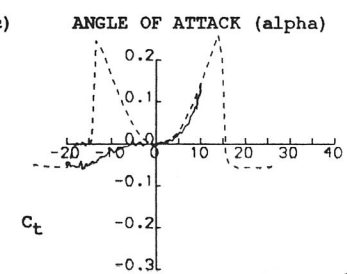








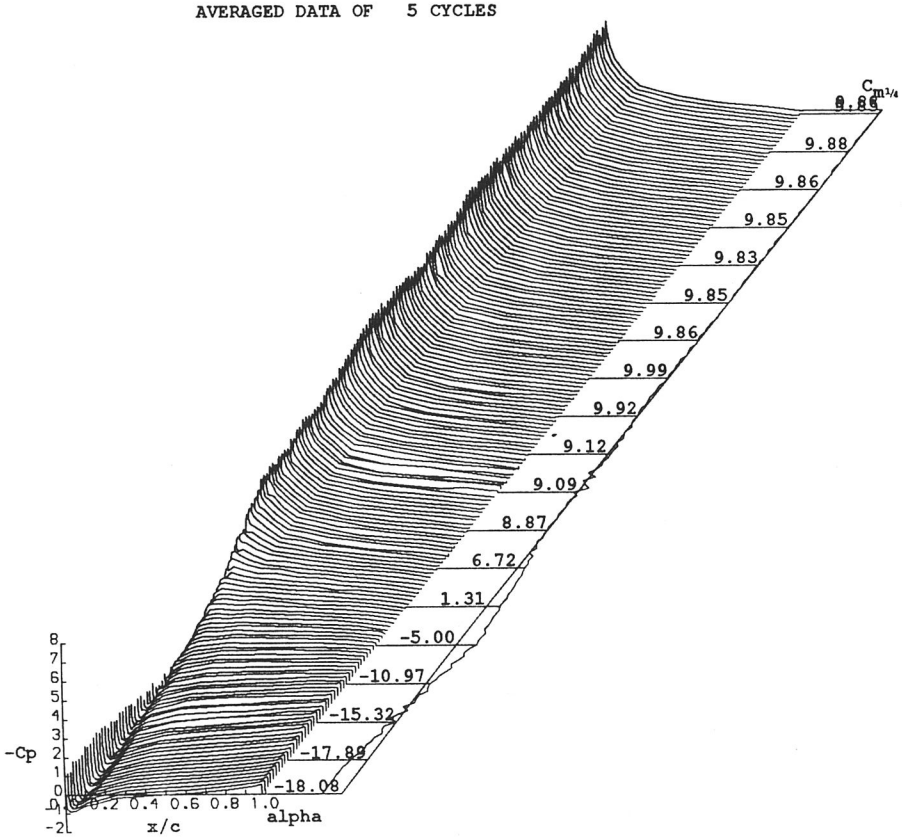


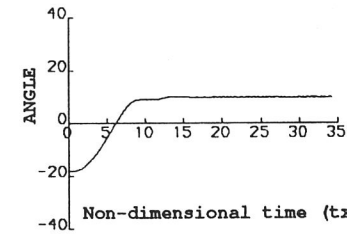


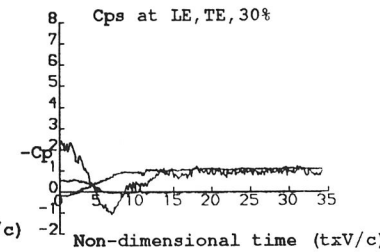
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

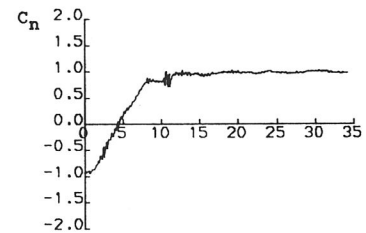
RUN REFERENCE NUMBER: 630971
REYNOLDS NUMBER = 1465403.
DYNAMIC PRESSURE = 982.12 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -18.00°
RAMP ARC = 28.000°
AVERAGED DATA OF 5 CYCLES

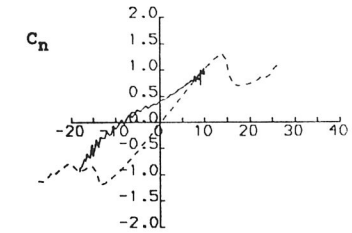
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.6°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03881
LINEAR PITCH RATE = $328.80°S^{-1}$

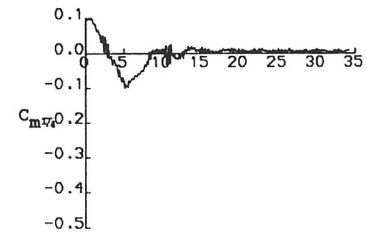


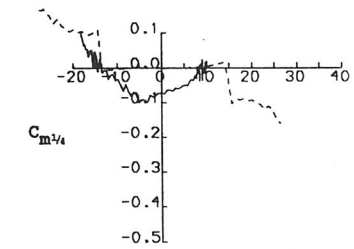


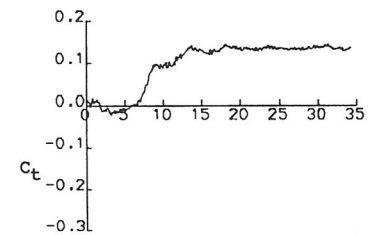


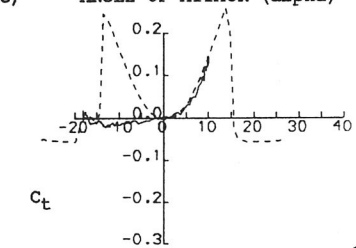








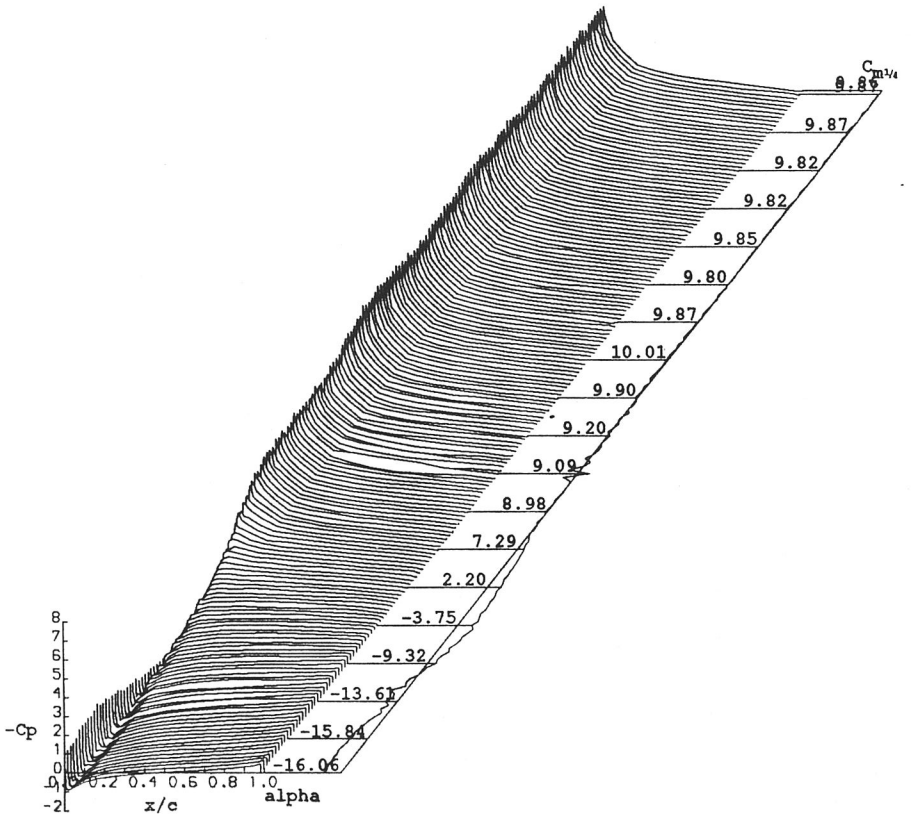


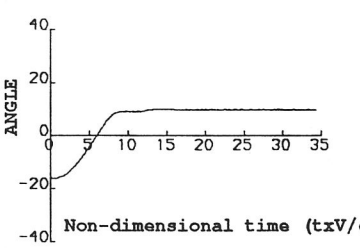


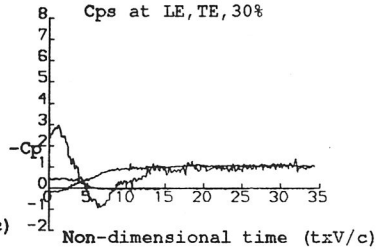
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

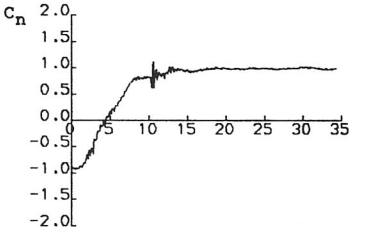
RUN REFERENCE NUMBER: 630981
REYNOLDS NUMBER = 1470077.
DYNAMIC PRESSURE = 987.55 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -16.00°
RAMP ARC = 26.000°
AVERAGED DATA OF 5 CYCLES

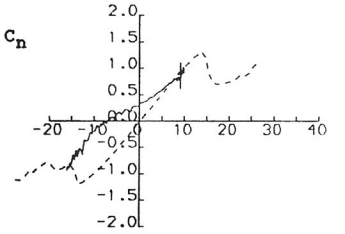
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03626
LINEAR PITCH RATE = 308.00°S^{-1}

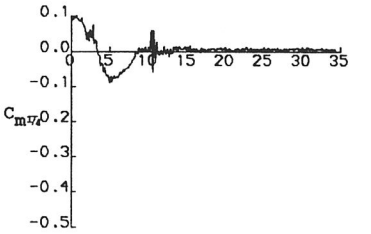


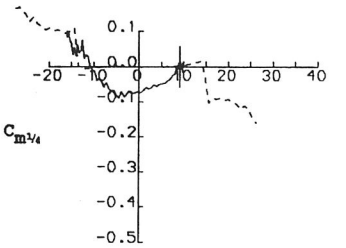


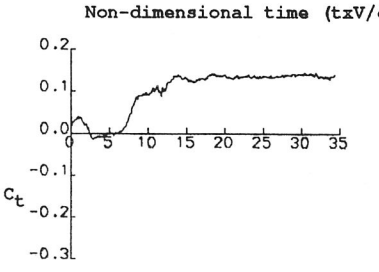


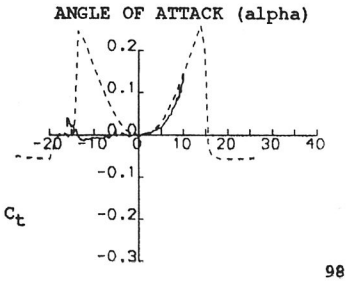








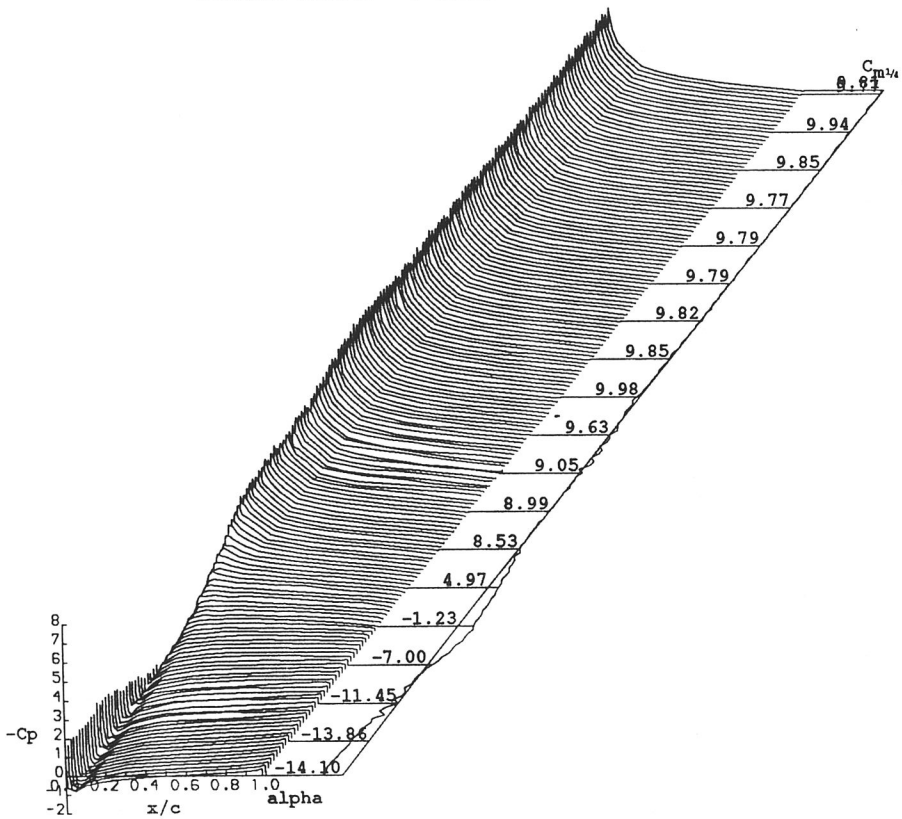


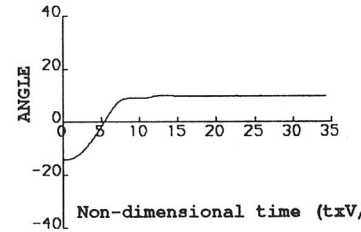


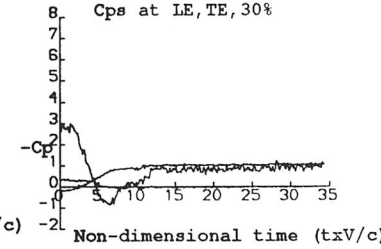
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

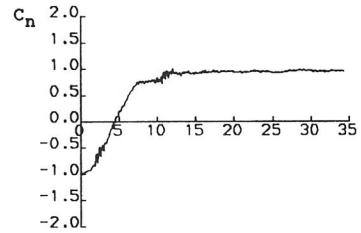
RUN REFERENCE NUMBER: 630991
REYNOLDS NUMBER = 1467567.
DYNAMIC PRESSURE = 987.55 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -14.00°
RAMP ARC = 24.000°
AVERAGED DATA OF 5 CYCLES

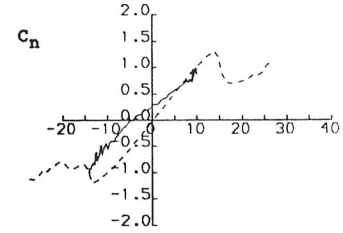
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03688
LINEAR PITCH RATE = 313.45°S^{-1}

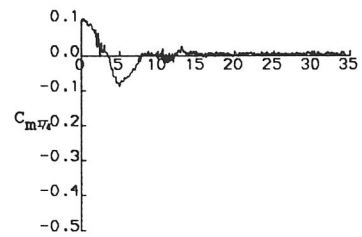


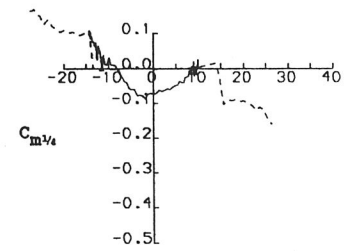


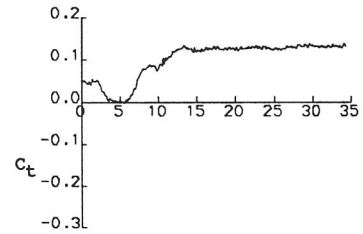


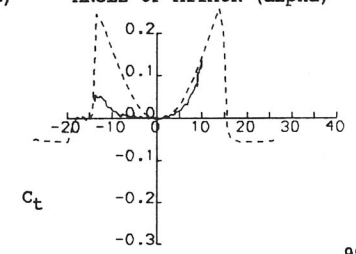








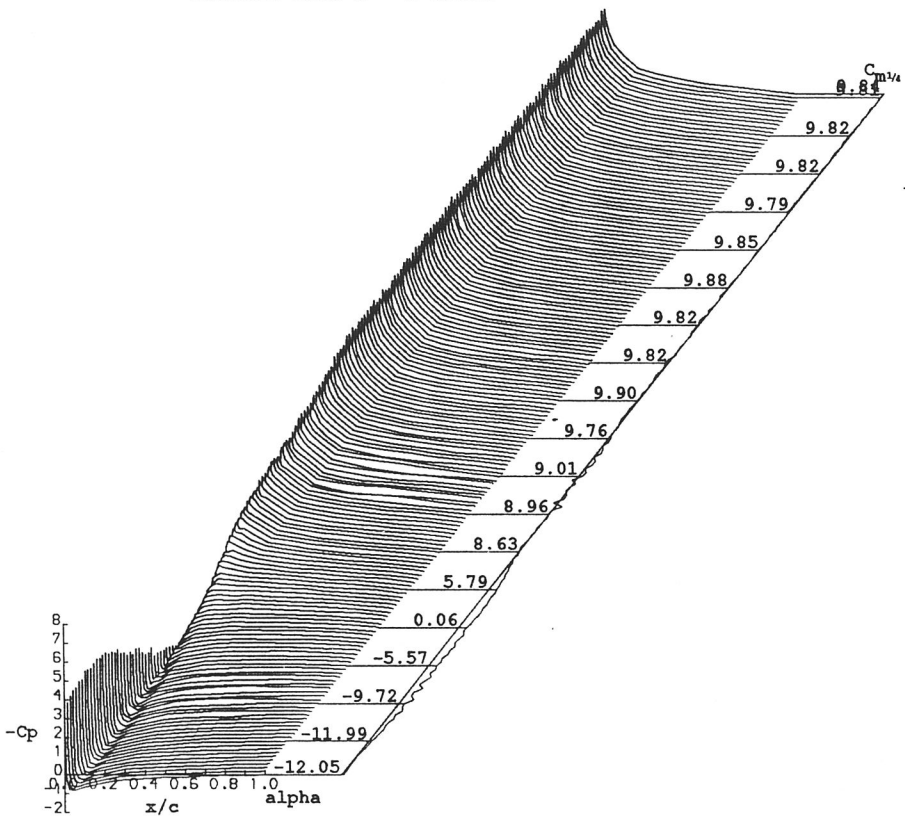


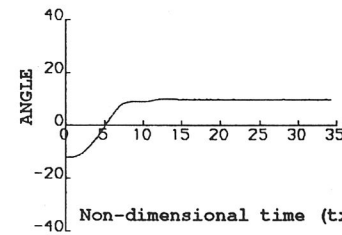


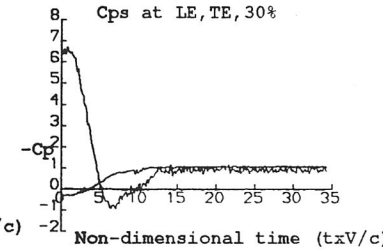
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

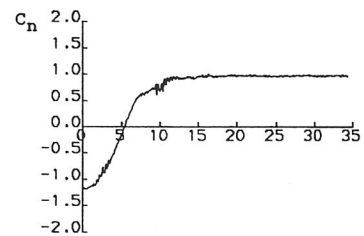
RUN REFERENCE NUMBER: 631001
REYNOLDS NUMBER = 1467567.
DYNAMIC PRESSURE = 987.55 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -12.00°
RAMP ARC = 22.000°
AVERAGED DATA OF 5 CYCLES

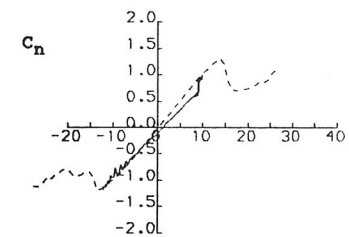
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 26.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03533
LINEAR PITCH RATE = 300.29°S^{-1}

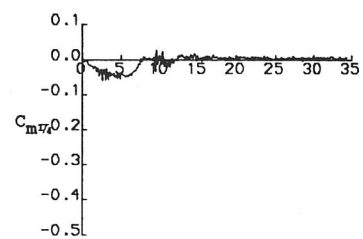


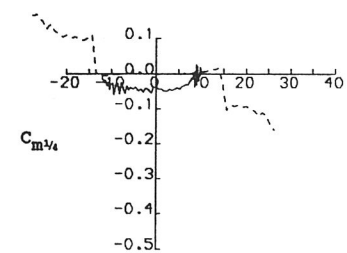


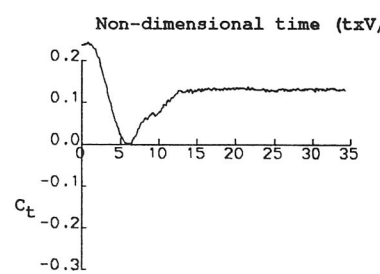


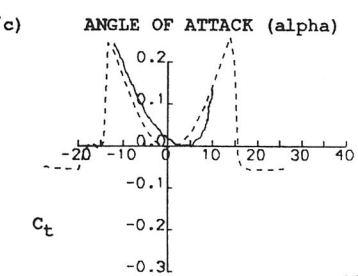








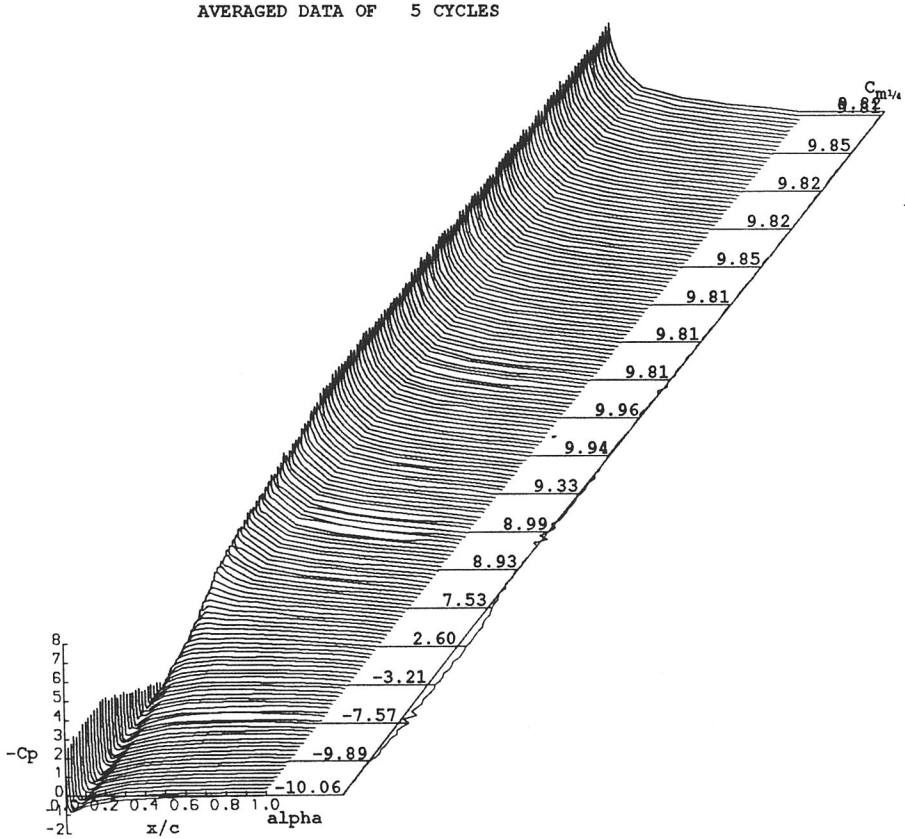


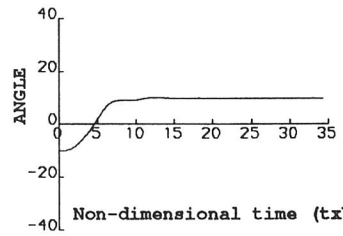


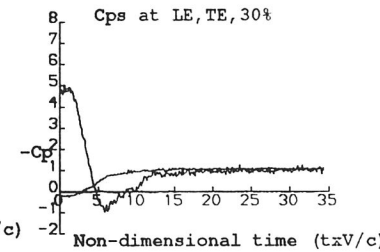
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

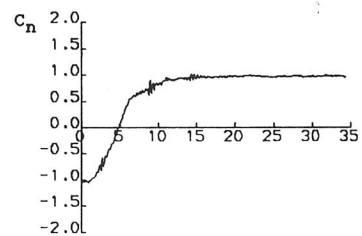
RUN REFERENCE NUMBER: 631011
REYNOLDS NUMBER = 1465691.
DYNAMIC PRESSURE = 987.55 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -10.00°
RAMP ARC = 20.000°
AVERAGED DATA OF 5 CYCLES

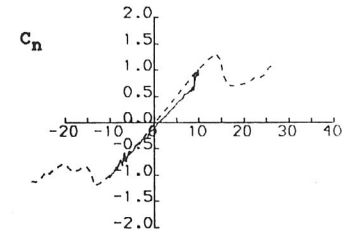
DATE OF TEST: 19/12/90
MACH NUMBER = 0.117
AIR TEMPERATURE = 27.2°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03456
LINEAR PITCH RATE = 293.87°S^{-1}

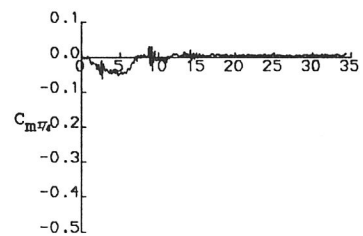


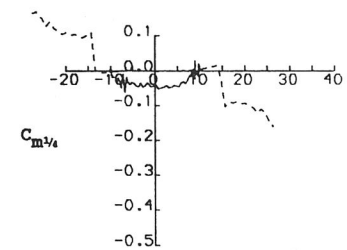


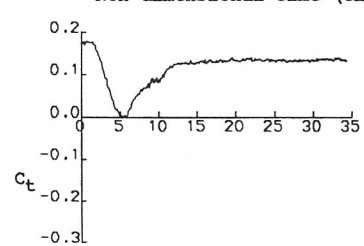


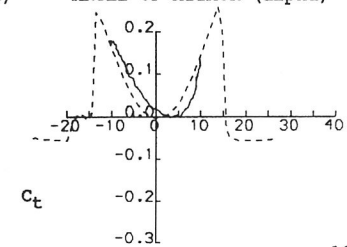








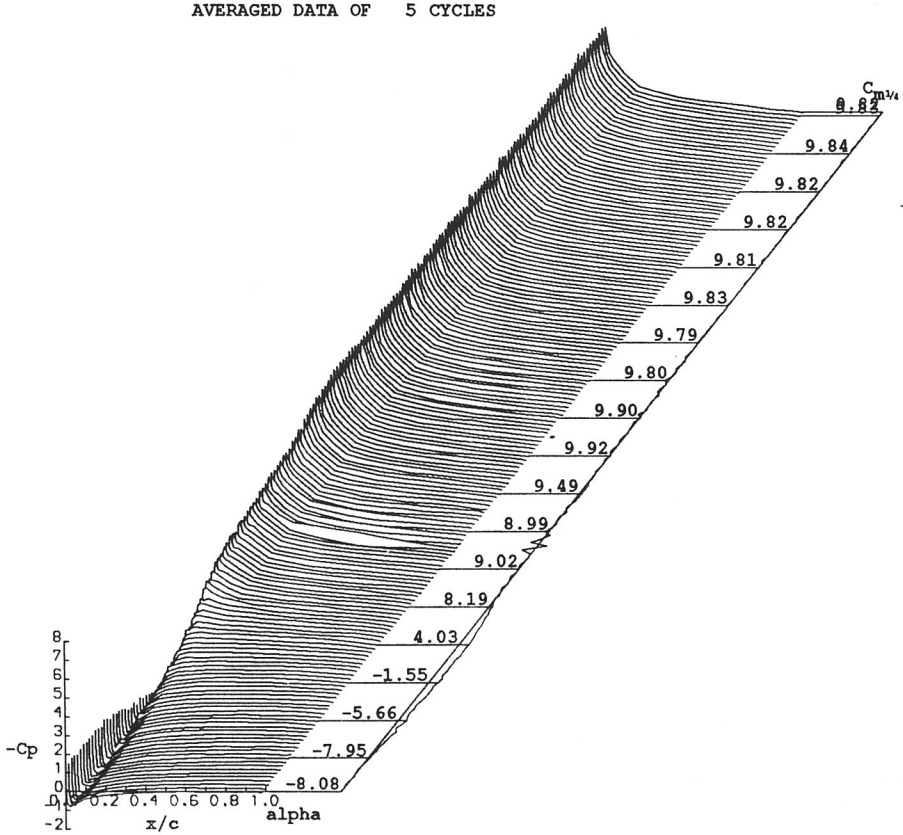


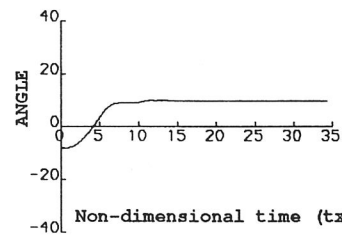


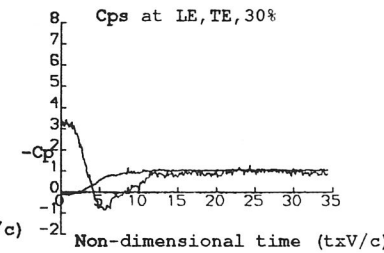
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

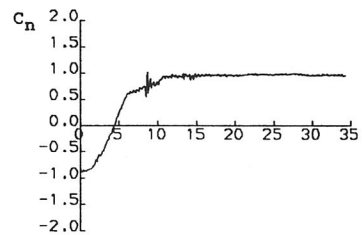
RUN REFERENCE NUMBER: 631021
REYNOLDS NUMBER = 1468254.
DYNAMIC PRESSURE = 988.47 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -8.00°
RAMP ARC = 18.000°
AVERAGED DATA OF 5 CYCLES

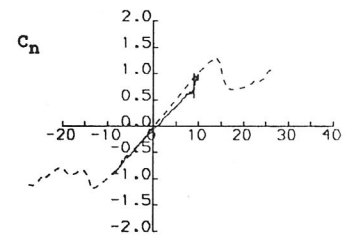
DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 26.9°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03154
LINEAR PITCH RATE = 268.17°S^{-1}

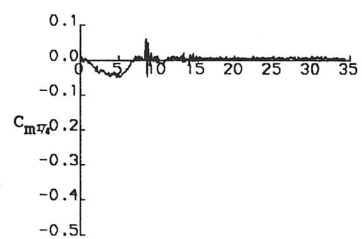


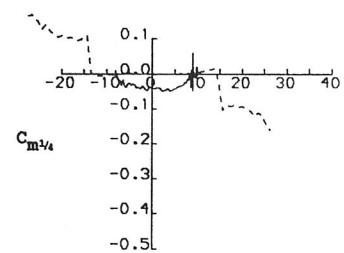


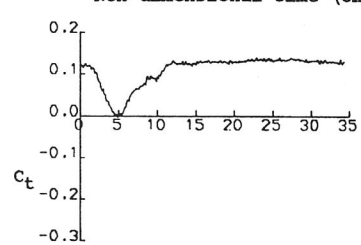


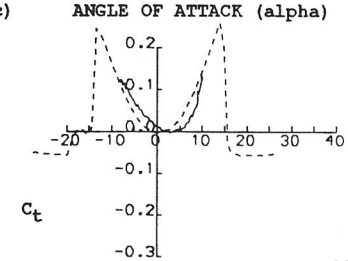








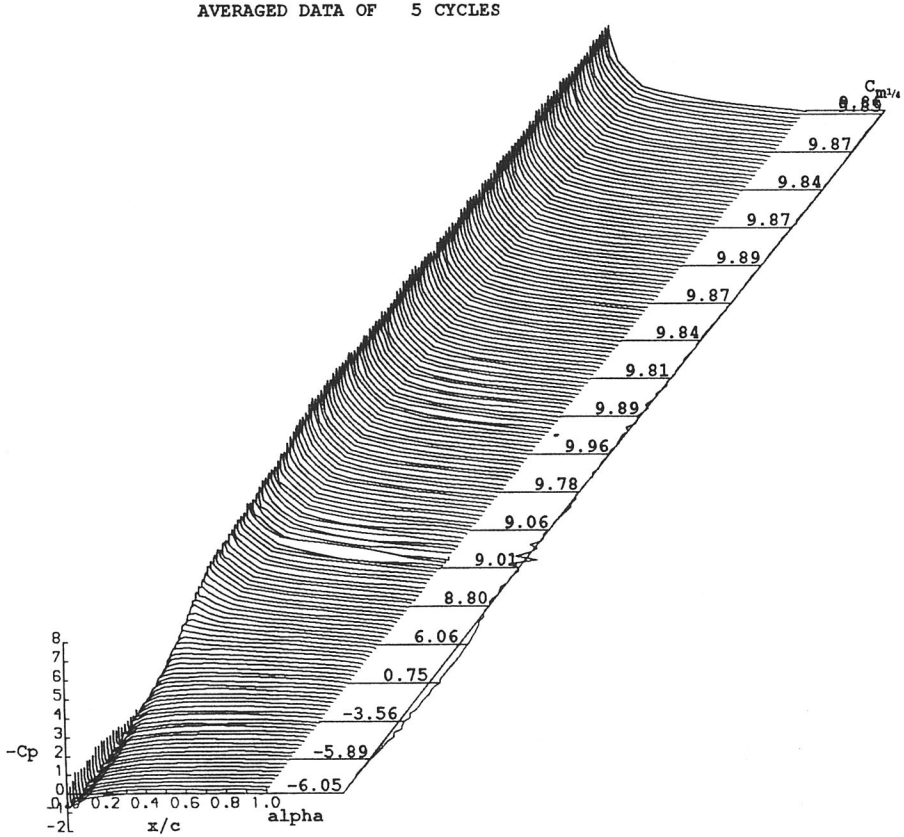


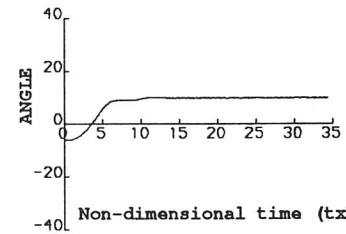


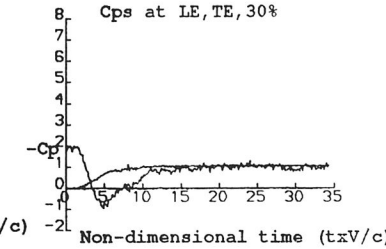
DYNAMIC CHARACTERISTICS FOR THE NACA 0012

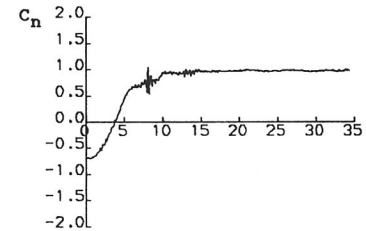
RUN REFERENCE NUMBER: 631031
REYNOLDS NUMBER = 1465751.
DYNAMIC PRESSURE = 988.47 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -6.00°
RAMP ARC = 16.000°
AVERAGED DATA OF 5 CYCLES

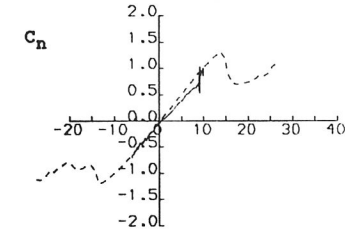
DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 27.3°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.03184
LINEAR PITCH RATE = 270.94°S^{-1}

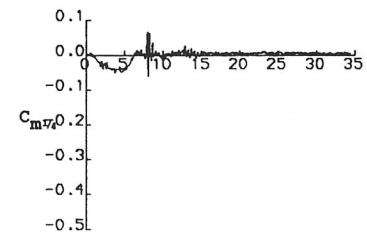


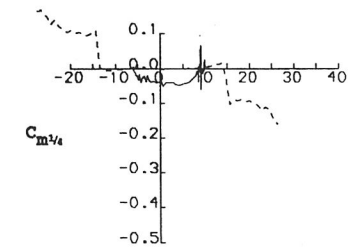


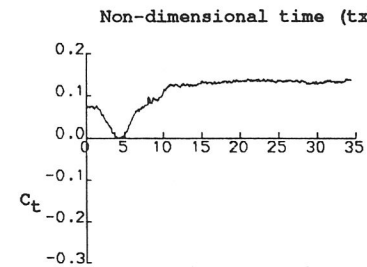


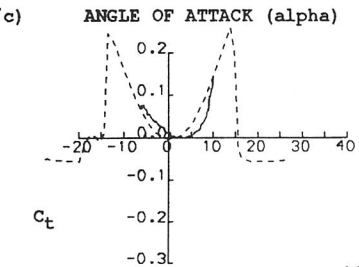












DYNAMIC CHARACTERISTICS FOR THE NACA 0012

RUN REFERENCE NUMBER: 631041
REYNOLDS NUMBER = 1464503.
DYNAMIC PRESSURE = 988.47 Nm^{-2}
NUMBER OF CYCLES = 5
MOTION TYPE: RAMP DOWN
START ANGLE = -4.00°
RAMP ARC = 14.000°
AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 19/12/90
MACH NUMBER = 0.118
AIR TEMPERATURE = 27.5°C
SAMPLING FREQUENCY = 550.05 Hz.
REDUCED PITCH RATE = 0.02969
LINEAR PITCH RATE = 252.75°S^{-1}